CHAPTER 4
IMPACTS OF THE ALTERNATIVES

Chapter 4 of the EA documents the analysis of impacts expected to result from the GAP alternatives evaluated in detail. This chapter is organized according to the same topic headings included in Chapter 3 and the issue topics identified in Chapter 1. The focus of the analysis is the specific resources, primarily those within or immediately adjacent to the park road corridor, that would most likely be subject to changed conditions resulting from gravel extraction, processing and hauling activities.

The characteristics of the five GAP alternatives, as described in detail in Chapter 2, provide the basis for the determination of the type and level of impacts expected to occur for each resource and alternative. Aside from the location of the respective activities, the key characteristics include the volume of material to be removed at the potential extraction sites, the corresponding area of disturbance at the sites and the site-specific plans for the configuration of mining activity at each site. These site-specific plans are documented in Appendix C.

The impact analysis has been conducted in a consistent manner based on standardized impact-level definitions. For each resource or issue area, direct, indirect and cumulative impacts have been characterized as negligible, minor, moderate or major. The impact level identified for each case was based on considerations of the applicable dimensions of the impact, including timing and duration, intensity and geographic extent. Table 4.1 summarizes impact definitions corresponding to the respective impact topics.

For many of the resources, assessment of the level of expected impacts is at least partially dependent upon the area of disturbance at the potential gravel sites. Table 4.2 summarizes the estimated area of surface disturbance for each site under the respective alternatives. The table distinguishes between new disturbance or expanded disturbance at previously developed material sites, as is the case for most of the potential extraction sites, and re-working of a previously disturbed mining area at the Downtown Kantishna site. Data addressing the total deposit area and the area expected to be disturbed for access road development are also included. The implications of the data presented in the table are discussed elsewhere in Chapter 4 for the respective resources.

The area of surface disturbance created by gravel extraction and processing is compared to the baseline level of existing development and disturbance within the road corridor. This has been done to provide context for the identified direct and indirect impacts, and to provide a quantitative basis for discussion of cumulative impacts. NPS estimates of the existing disturbed area within the park road corridor are indicated in Table 4.3. In Table 4.3 visitor facilities include features such as campgrounds, rest stops and other structures developed specifically to serve the park visitor population. The area for the park road is based on an assumed 30-foot average width of disturbance along the 93-mile length of the road. The Other Infrastructure category includes sewage lagoons, the airstrip and railroad depot, and existing gravel pits (active and inactive) within the park.

TABLE 4-1 DEFINITIONS OF IMPACT LEVELS

IMPACT TOPIC	IMPACT LEVEL			
	Negligible	Minor	Moderate	Major
Physical Resources (Air & Water Quality, Geologic Resources, Floodplain, & Hydrology)	Little or no change in physical resources.	Short-term changes to physical resources that occur in a small geographic area.	Short-term changes to physical resources occur over a large geographic area or long-term changes occur over a small, localized area.	Long-term changes to physical resources occur over a large geographic area
Vegetation & Wetlands	Little or no change in vegetation or wetlands.	Short-term changes to vegetation or wetlands occur in a small geographic area.	Short-term changes to vegetation or wetlands occur over a large geographic area or long-term changes occur over a small, localized area.	Long-term changes to vegetation or wetlands occur over a large geographic area.
Wildlife & Aquatic Resources	Little or no change in wildlife or aquatic resources.	Short-term local changes in wildlife or aquatic resource populations or habitats.	Short-term widespread changes to wildlife or aquatic resource populations or habitat.	Long-term widespread changes to wildlife or aquatic resource populations or habitat.
Cultural Resources	Little or no change in cultural sites.	Some change to a limited number of cultural sites and/or a unique representative class of cultural resources	Some change to widespread/numerous cultural sites and /or unique representative class of cultural resources.	Complete or near complete change of multiple cultural sites and /or a unique representative class of cultural resources.
Visitor Use & Experience	Little or no change in visitor use or experience.	Short-term, local change in visitor use or experience.	Short-term, widespread change in visitor use or experience.	Long-term, widespread change in visitor use or experience.
Scenic Values	Little or no change in scenic values.	Short-term changes to scenic values occur in a small geographic area.	Short-term changes to scenic values occur over a large geographic area or long-term changes occur over a small, localized area.	Long-term changes to scenic values occur over a large geographic area.
Public Access & Safety	Little or no change in public access or safety.	Short-term, local change in public access or safety.	Short-term, widespread change in public access or safety.	Long-term, widespread change in public access or safety.
Wilderness	Little or no change in wilderness character or status.	Small changes in wilderness character affect only a small part of the park.	Modest changes in wilderness character affect a substantial part of the park or large changes affect a only a small part of the park.	Substantial changes in wilderness character affect a large portion of the park.
Park Management	Little or no change in staffing levels, or management operations or priorities.	Required management adjustments can be made over the short-term (1-2 years).	Most management adjustments can be made over the short-term (1-2 years), some require an additional 1-2 years.	Broad –based management adjustments, generally require several years to implement.
Local Economy	Little or no noticeable change in economic activity.	Local changes in economic activity.	Regional changes in overall economic activity.	Widespread significant changes in overall economic activity.

TABLE 4.2 AREA OF DISTURBANCE, BY SITE AND ALTERNATIVE

Gravel Source	Total Volume of Deposit (cy)	Total Deposit Area (ac)[1]	Area of Access Roads[4]	Area Disturbed Alt. 1	Area Disturbed Alt. 2	Area Disturbed Alt. 3	Area Disturbed Alt. 4	Area Disturbed Alt. 5
New Disturbance								
Teklanika	75,000	1.5	-	0.7	1.3	0.1	1.4	1.4
East Fork River	[2]	[2]	-		[5]		[5]	[5]
Toklat River	[2]	[2]	-	[5]	[5]	[5]	[5]	[5]
Beaver Pond	70,000	3.5	0.1	0.0	1.2	0.0	1.1	1.1
Boundary	39,000	2.4	0.1	0.0	0.8	0.0	0.0	0.0
Moose Creek Terrace	164,000	3.7	0.1	0.0	0.0	2.5	0.8	0.0
North Face Corner	157,500	3.6	-	0.2	0.0	0.0	0.0	0.7
Camp Ridge	72,000	4.5	-	0.0	0.2	0.0	0.0	0.0
Kantishna Airstrip	77,000	7.6	0.2	0.0	1.1	0.0	0.0	0.0
New In-Park Total		**26.8**	**0.5**	**0.9**	**4.6**	**2.6**	**3.3**	**3.2**
Previously Disturbed Sites								
Downtown Kantishna	59,000	55.2	0.0	0.0	42	0.0	42	42
Total In-Park Area			**0.5**	**0.9**	**46.6**	**2.6**	**45.3**	**45.2**
External Sources	[3]	[3]	-	34.1	2.0	18.1	2.0	2.0
Total Disturbed Area			**0.5**	**35.0**	**48.6**	**20.7**	**47.3**	**47.2**

[1] Represents maximum possible area of disturbance at site if contingencies required shifting of volumes among sites.
[2] Not applicable, because the excavation would be in active floodplain.
[3] Estimated from ratio of average volume to average area of in-park sources.
[4] Where dashed, there is either an existing road, or source is immediately adjacent to Park Road
[5] Surface disturbance for equipment access and mirror-channel extraction cuts would occur seasonally, be obliterated in short term through natural processes.

TABLE 4.3 EXISTING AREA OF SURFACE DISTURBANCE, PARK ROAD CORRIDOR

Type of Facility	Surface Area (acres)
Visitor Facilities	83
Park Road	335
Other Infrastructure	47
NPS Administrative Facilities	60
Total	**525**

Another key measure in the impact analysis for several resources is the amount of gravel hauling activity that would be added to the park road through implementation of the respective GAP alternatives, and the relationship of that activity to the existing level of total vehicle miles on the park road. The NPS estimates that total annual visitor and administrative traffic on the park road amounts to nearly 1.5 million vehicle miles, distributed as shown in Table 4.4.

TABLE 4.4 ESTIMATED CURRENT ANNUAL VEHICLE MILES BY TRAFFIC TYPE

Traffic Component	Vehicle Miles
Shuttle Buses	702,000
Long Tour Bus Trips	267,000
Short Tour Bus Trips	43,000
Teklanika Private Vehicles	64,000
Kantishna Inholders	216,000
NPS Admin Travel	189,000
Total	**1,481,000**

The aggregate annual figure of 1.5 million vehicle miles is based on the number of vehicle trips of each type recorded at the Savage River check station and an assumed average or typical round-trip distance for each traffic component. (For example, short tour bus trips typically have a turnaround-point at MP 17, and therefore account for 34 total miles on the park road for each trip, and only 4 miles on the gravel part of the park road.) The vehicle mileage estimate includes very little existing trucking activity associated with hauling gravel to maintenance locations within the park road corridor, because of the manner in which vehicle trips are recorded. A dump truck used for hauling gravel would be counted as a single vehicle trip for the entry and exit by the Savage River Checkpoint, but it could actually log dozens of trips shuttling loads of gravel between Toklat, for example, and various points along the park road. Consequently, the current gravel-hauling vehicle mileage is not monitored by the NPS and is unknown. NPS maintenance personnel estimate each dump truck is driven about 400 hours each season at an average 20 mph or 8,000 miles per season. The park's 6 dump trucks would then be estimated to contribute about 48,000 vehicle miles each year. This estimate does not include the gravel truck miles from contractor trucks passing the Savage Checkpoint, which would be included in the administrative travel in Table 4.4.

The five GAP alternatives would generate gravel-hauling activity producing about 105,000 to 228,000 average annual vehicle miles. The primary determinants of the total level of gravel truck mileage for a given alternative are the volume of material to be supplied by external sources and the geographic distribution of in-park gravel sources. Table 4.5 summarizes the estimated vehicle miles per alternative, as reported in the detailed estimates in Appendix B. Because the existing level of gravel-hauling activity was not tracked, it is not possible to make a direct comparison of the vehicle mileage figures shown in Table 4.5 to the corresponding baseline figures for gravel hauling. However, the approximate relationship can be illustrated by comparing gravel volumes used in recent years to the volumes anticipated under the GAP. As indicated in Appendix A, actual park gravel use amounted to approximately 33,000 cy in 2000, 25,000 cy in 2001 and 48,000 cy in 2002, for an annual average of about 35,000 cy over the past 3 years. The volume of gravel needed over the next 10 years is projected to average about 37,500 cy per year. This represents a slight increase (approximately 7 percent) compared to the annual average for the 2000-2002 period.

TABLE 4.5 SUMMARY OF GRAVEL TRUCK VEHICLE MILES, BY ALTERNATIVE[1]

Alternative	Total Miles (10 years)	Ave. Miles per Year	Percent of Current Total
1	2,279,919	228,000	16
2	1,103,780	110,000	7
3	1,746,164	175,000	12
4	1,061,371	106,000	7
5	1,051,131	105,000	7

[1] Stated as equivalent percentage to current estimated baseline level of approximately 1,481,000 annual vehicle miles

From Table 4.5 it is evident that Alternatives 2, 4 or 5 would result in essentially the same level of gravel-hauling activity on the park road, while Alternatives 3 and 1 would result in considerably higher levels of activity. This comparison is discussed at several points in the impact analysis, along with the level of gravel-hauling activity relative to the existing volume of visitor and administrative traffic on the park road.

CLIMATE AND AIR QUALITY

Current park management activities, including gravel acquisition operations along the park road corridor, generate minor amounts of airborne pollutants. The primary in-park sources of air pollution include dust and vehicle exhaust emissions generated by traffic along the park road, and dust and vehicle exhaust emissions by vehicles and equipment used for gravel acquisition and road maintenance activities.

Airborne pollutants produced by construction equipment (including gravel extraction, processing, and hauling equipment) include emissions of carbon monoxide, sulfur dioxide, nitrogen oxides, volatile organic compounds (e.g., reactive hydrocarbons) and particulate matter. Gasoline and diesel-powered vehicles traveling on the park road emit many of these same pollutants, in addition to causing an increase in ambient dust levels along the road corridor. Gravel extraction and processing activities also produce particulate matter in the form of dust.

Road dust may interfere with plant respiration, and has been associated with major increase in the pH of the organic layer and a decline in the height of live moss (Walker and Webber 1980; Spatt and Miller 1981; Walker and Everett 1987; NPS 1996a; NPS 1996b). To mitigate potential impacts, the NPS would continue to apply dust palliatives and particle binders to the road surface. Expansion of the area of the park road on which dust palliatives are used could help to reduce the dust emissions created by gravel hauling and other traffic.

The GAP alternatives would have impacts on air quality similar to those caused by existing activities. The activity sources of airborne pollutants resulting from implementation of the plan would be (1) operation of extraction, processing, and construction equipment and (2) trucks hauling gravel on the park road. In all cases the relative emission contribution from extraction and processing equipment would depend on the volume of material extracted. Likewise, the contribution of emissions from material hauling would depend primarily on the volume of material transported and the total vehicle mileage traveled. Emissions and dust from road repair and maintenance would be equivalent for all of the alternatives, as these activities would not change due to the chosen alternative.

Although activities associated with the gravel acquisition plan might cause short-term and localized degradation of air quality, the impact would be minor in the context of the park's overall excellent air quality, which has been monitored near park headquarters for over 15 years (NPS 2002.) Adherence to the seasonal traffic limits established in the GMP would keep total traffic on the park road, and therefore total vehicle emissions and dust volumes associated with visitor and administrative traffic, at or near existing levels. While the four action alternatives would result in an increase in the volume of gravel extracted and processed in the park over the 10-year planning period, this would be an incremental change to the level of an existing airborne pollutant source and not a major new source. In addition, vehicle emissions and dust associated with gravel operations would be produced on an intermittent basis within a long, narrow corridor of the park; they would likely be dispersed to background levels relatively near the road corridor. Based on such volume and distribution conditions, the emissions associated with any of the five alternatives would represent minor to moderate changes to air quality in the park, as discussed for each alternative below.

Alternative 1: No Action

Under this alternative gravel acquisition, processing and storage would continue at currently approved sites. Direct impacts to air quality from gravel extraction and processing would continue as at present, and no additional sources of air pollutants would be introduced through this alternative. As indicated in Table 4.5, however, total gravel hauling mileage would amount to approximately 228,000 vehicle miles, representing a figure equivalent to about 16 percent of the current volume of park road visitor and administrative traffic. Compared to actual miles driven by gravel trucks over the past three years, Alternative 1 would likely result in a doubling of gravel-hauling activity. These impacts would be long-term, intermittent, and limited to a relatively small area (the park road corridor); based on the impact level definitions presented in Table 4.1 they would be considered moderate in the road corridor.

Cumulative Impacts: Existing human-caused air emissions in the park primarily consist of exhaust and fugitive dust created by vehicle traffic along the park road. Airborne contaminants from Eurasian industrial and agricultural practices travel across the Pacific Ocean, peak in the spring, and have caused periods of moderate arctic haze. Future actions in and around the park area, such as increased tourism activity, air traffic, and off-road vehicle use are likely to have little impact on air quality in the park road corridor. The 16% increase in vehicle mileage on the park road from gravel hauling activity that is due to this alternative would cause an incremental increase in the volume of airborne pollutants. Due to the localized and repetitive nature of the current and future impacts to air quality, the cumulative impacts on air quality in the park would be moderate.

Conclusion: With the two-fold increase in trucking activity resulting in 16% of the overall traffic and widespread increase in dust emissions along the park road, the overall impacts to air quality along the road corridor from the no-action alternative would be moderate. The level of impacts to air quality from Alternative 1 would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are key to the natural integrity of the park.

Alternative 2: Maximum Flexibility/Short Hauls

Alternative 2 would authorize extraction and/or processing of mineral material at up to nine sites (three existing sites and six new extraction sites) distributed along the park road corridor from Teklanika to the Kantishna area. Direct impacts to air quality would include exhaust emissions from gravel extraction and processing equipment operating at the source sites, and dust generated by extraction and processing activities. Because this alternative involves the greatest number of operating sites, the geographic distribution of dust and emissions produced at extraction and processing sites would be most widespread under this alternative. The total volume of airborne pollutants from gravel extraction would result in a small increase over the volume produced by recent gravel operations.

Indirect impacts would occur as a result of trucks hauling mineral materials to various locations along the park road, and would also include exhaust emissions and dust from the vehicular activity. Dust and emissions produced by trucks hauling material along the park road would be comparatively low, as the aggregate hauling distance (110,000 miles) under this alternative would be equal to about 7 percent of the current annual visitor and administrative traffic on the park road (1,481,000 miles.) Dust and engine emissions generated by extraction operations and truck traffic would represent a small incremental addition to the volume of other traffic on the park road and the associated emissions. Because this alternative relies primarily on in-park resources and would provide relatively short average haul distances, it is possible that total vehicle mileage for hauling gravel would actually

be less than the current baseline level. Both types of air emissions would occur intermittently during the annual operating season and would be localized in the vicinity of the road corridor. Based on the incremental nature of these air quality impacts and their timing characteristics, the airborne pollutants from this alternative would have a minor direct and indirect impact on air quality in the park.

Cumulative Impacts: Existing human-caused air emissions in the park primarily consist of exhaust and fugitive dust created by vehicle traffic along the park road. Airborne contaminants from Eurasian industrial and agricultural practices travel across the Pacific Ocean, peak in the spring, and have caused periods of moderate arctic haze. Future actions in and around the park area, such as increased tourism activity, air traffic, and off-road vehicle use are likely to have little impact on air quality in the park road corridor. The 7 % increase in vehicle mileage on the park road from gravel hauling activity that is due to this alternative would cause an incremental increase in the volume of airborne pollutants. Due to the localized and repetitive nature of the current and future impacts to air quality, the cumulative impacts on air quality in the park would be moderate.

Conclusion: The overall level of impacts to air quality under Alternative 2 would be minor and would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 3: Minimum Visual Intrusion/Long Hauls

The air quality impacts of Alternative 3 would be similar to those described above for Alternative 1. Dust and vehicle emissions from gravel extraction and processing operations would occur at three sites, including the Teklanika and Toklat River sites used in Alternative 1 and the new Moose Creek Terrace site. These emissions would be localized, intermittent, and long-term (10 years.) Indirect air quality impacts associated with 175,000 gravel truck miles would be 25 % less than for Alternative 1 but much more than in recent years, resulting in widespread new dust emissions along the park road corridor.

Cumulative Impacts: Existing human-caused air emissions in the park primarily consist of exhaust and fugitive dust created by vehicle traffic along the park road. Airborne contaminants from Eurasian industrial and agricultural practices travel across the Pacific Ocean, peak in the spring, and have caused periods of moderate arctic haze. Future actions in and around the park area, such as increased tourism activity, air traffic, and off-road vehicle use are likely to have little impact on air quality in the park road corridor. The 12 % increase in vehicle mileage on the park road from gravel hauling activity that is due to this alternative would cause an incremental increase in the volume of airborne pollutants. Due to the localized and repetitive nature of the current and future impacts to air quality, the cumulative impacts on air quality along the park road corridor would be moderate.

Conclusion: The overall impacts to air quality along the park road from alternative 3 would be moderate. The level of impacts to air quality from Alternative 3 would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are key to the natural integrity of the park.

Alternative 4: Phased Development of a Moderate Number of Sites *(NPS Preferred)*

This alternative would authorize the use of six borrow sites, with the sites in the Kantishna area utilized in two phases. Dust and vehicle emissions from gravel extraction and processing would be somewhat more widely distributed than with Alternative 3 and somewhat less widely distributed than

with Alternative 2, but the same in volume. Pollutants from truck miles along the park road would be virtually the same as for Alternative 2 (see Table 4.4), and at most a slight increase over the effects of current traffic on the park road. Airborne pollutants from this alternative would have a minor direct and indirect impact on air quality in the park.

Cumulative Impacts: Existing human-caused air emissions in the park primarily consist of exhaust and fugitive dust created by vehicle traffic along the park road. Airborne contaminants from Eurasian industrial and agricultural practices travel across the Pacific Ocean, peak in the spring, and have caused periods of moderate arctic haze. Future actions in and around the park area, such as increased tourism activity, air traffic, and off-road vehicle use are likely to have little impact on air quality in the park road corridor. The 7 % increase in vehicle mileage on the park road from gravel hauling activity that is due to this alternative would cause an incremental increase in the volume of airborne pollutants. Due to the localized and repetitive nature of the current and future impacts to air quality, the cumulative impacts on air quality in the park would be moderate.

Conclusion: The air quality impacts of Alternative 4 would result in minor levels of airborne pollution within the park road corridor. The overall level of impacts to air quality under Alternative 4 would be minor and would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

This alternative is virtually the same as Alternative 4, with the difference being that North Face Corner would be used instead of Moose Creek Terrace after the supply of gravel from Downtown Kantishna was exhausted. The total volume of dust and vehicle emissions and their time distribution would be virtually the same as for Alternative 4, and the impacts from this alternative would be minor.

Cumulative Impacts: Existing human-caused air emissions in the park primarily consist of exhaust and fugitive dust created by vehicle traffic along the park road. Airborne contaminants from Eurasian industrial and agricultural practices travel across the Pacific Ocean, peak in the spring, and have caused periods of moderate arctic haze. Future actions in and around the park area, such as increased tourism activity, air traffic, and off-road vehicle use are likely to have little impact on air quality in the park road corridor. The 7 % increase in vehicle mileage on the park road from gravel hauling activity that is due to this alternative would cause an incremental increase in the volume of airborne pollutants. Due to the localized and repetitive nature of the current and future impacts to air quality, the cumulative impacts on air quality in the park would be moderate.

Conclusion: The air quality impacts of Alternative 5 would result in minor levels of airborne pollution within the park road corridor. The overall level of impacts to air quality under Alternative 5 would be minor and would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

GEOLOGIC RESOURCES

Pertinent issues associated with geologic resources include the need for long-term availability of borrow source material, the potential for extraction activities to undermine overlying strata and compromise slope stability, the potential for accelerated erosion and potential impacts related to the influence of extraction activities on permafrost.

The glacial history of Denali and the Alaska Range created extensive gravel resources in the morainal and outwash deposits on the north side of the range. Even within the confines of the road corridor and its adjacent development nodes, readily accessible gravel supplies are abundant. The 10 candidate gravel extraction sites evaluated in this EA represent a potential gravel supply of well over 750,000 cy, or more than double the total gravel needs identified by the NPS for the 10-year planning period. The NPS has identified other possible gravel sites along the road corridor that are not now under consideration for active use, but that could potentially supply gravel in the future if conditions warranted. Deposits along the park road corridor are constrained by designated Wilderness, the road corridor itself, wetlands, and other screening criteria identified in Chapter 1. Extraction at these finite resources in the next 10 years would diminish the available supply for future generations, except from replenished sites like Toklat River.

The potential for slope stability effects from implementation of the proposed plan is limited by site conditions and operating plans. Slopes within the active working area of upland gravel pits would, by definition, be unstable while they were being excavated. However, the active pit areas would not be adjacent to slopes that could be undermined and subject to failure. The candidate upland excavation sites are generally located on topographic benches in areas of little local relief. Areas within the mining operation that were not needed for stockpiles, access and loading would be reclaimed concurrently with extraction operations, and at the end of the operating period each site would be recontoured and restored. Gravel mining at the floodplain extraction sites would occur within the braided river channel areas, and would not be located adjacent to riverbanks that could be undercut. Therefore, it is unlikely that extraction operations for any of the alternatives would create slope stability risks outside of the defined extraction areas.

Disturbed areas within the active extraction sites would be subject to potential erosion during the interval between vegetation clearing and site restoration. The mining plans for all sites include provisions to limit erosion and control surface runoff during the active operating period for each site, and operational monitoring would include erosion and related resource protection concerns. All mined areas would be fully restored after operation, including revegetation and measures to control runoff. Consequently, none of the alternatives under consideration should result in accelerated erosion in off-site areas of the park.

The main effect of alteration of permafrost is to create potential for damage to buildings and infrastructure. Differential settlement of the soil due to thawing of permafrost can damage foundations, disrupt linear utilities (buried pipelines and cables) and damage roadbeds. However, none of the proposed gravel removal sites in the park is near buildings or other infrastructure, and no buried pipelines or cables cross in or near the proposed sites. While the park road is near the proposed extraction sites, the site locations are generally uphill and/or several hundreds of feet from the road. Therefore, any influence of extraction activity on thermokarst development would be unlikely to affect the road. Similarly, no existing structures are located close to any of the candidate extraction sites. Therefore, none of the alternatives would have off-site effects related to permafrost or thermokarst.

Alternative 1: No Action

Gravel extraction activities at three locations within the park would result in consumption of approximately 120,000 to 130,000 cy from in-park resources (including the contingency allowance) over a 10-year period. About 75,000 cy of this material would come from Toklat River, which is replenished by river bed load transport over a short term following removal. Alternative 1 would also consume approximately 220,000 to 240,000 cy of material from an undetermined number of external gravel sources, which would presumably represent a small quantity relative to the total supply available in river valley locations outside of the park. . Extraction activities at three sites within the park and at undetermined external source locations would be unlikely to result in off-site slope stability or erosion concerns. No structures within the park would be subject to potential damage through changes in permafrost/thermokarst conditions. The activities undertaken to implement Alternative 1 would result in virtually no change at Toklat River and a small change at Teklanika Pit and North Face Corner as indicated in Tables 4.2. The impacts from this alternative on geological resources would be negligible.

Cumulative Impacts: Previous impacts to geological resources have occurred along the park road and entrance area, primarily from the removal of mineral materials to construct the park road and other park facilities (see Table 4.3). Numerous borrow sites occur along the road corridor, many of which have become overgrown with native vegetation. Past placer mining and related access in the Kantishna Hills impacted about 1,500 acres of area. Less than one acre of area would be affected in the next ten years with this alternative. The total impacts of the past, ongoing, and proposed gravel mining operations would be moderate to geological resources.

Conclusion: Alternative 1 would create negligible off-site impacts involving slope stability, erosion or permafrost and would permanently remove less than 45,000 cy of gravel resources from about one acre of area within the park. The overall level of impacts to geologic resources under Alternative 1 would be minor and would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 2: Maximum Flexibility/Short Hauls

Gravel extraction activities at eight locations within the park would result in consumption of a total of up to about 330,000 to 360,000 cy from in-park resources, about half of the volume identified in the site plans. About 56 % of that volume would not be renewable, creating a subtle, localized, and long-term impact on identified gravel resources. Alternative 2 would also consume approximately 12,500 cy of material from external gravel sources, which would presumably represent a minimal quantity relative to the total supply available in river valley locations outside of the park. Gravel volumes removed from the East Fork and Toklat River floodplains would be replenished through natural sediment deposition over a short term following removal. Extraction activities at the eight sites within the park and at undetermined outside source locations would be unlikely to result in off-site slope stability or erosion concerns. No structures within the park would be subject to potential damage through changes in permafrost/thermokarst conditions. The activities undertaken to implement Alternative 2 would impact up to 4.6 acres of new area and 42 acres of previously disturbed area over the next 10 years (Table 4.2), leading to a moderate impact to geological (gravel) resources along the park road corridor.

Cumulative Impacts: Previous impacts to geological resources have occurred along the park road and entrance area, primarily from the removal of mineral materials to construct the park road and other park facilities (see Table 4.3). Numerous borrow sites occur along the road corridor, many of

which have become overgrown with native vegetation. Past placer mining in the Kantishna Hills and related access impacted up to 1,500 acres of area. Less than five acres of area would be affected in the next ten years with this alternative. The total impacts of the past, present, and proposed mining operations would be moderate to geological resources.

Conclusion: Alternative 2 would create the potential for negligible off-site impacts involving slope stability, erosion or permafrost and would not be likely to have a measurable effect on the integrity of geologic resources within the park. About 200,000 cy of gravel would be permanently removed from a small area of previously undisturbed upland sites resulting in a moderate impact to gravel resources. The overall level of impacts to geologic resources under Alternative 2 would be moderate and would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 3: Minimum Visual Intrusion/Long Hauls

Gravel extraction activities at three locations within the park would result in consumption of a total of approximately 220,000 to 240,000 cy from in-park resources. About half of that volume would be nonrenewable gravel, resulting in a subtle, localized or minor impact on identified park gravel sources. Alternative 3 would also consume approximately 121,000 to 130,000 cy of material from external gravel sources, which would presumably represent a small quantity relative to the total supply available in river valley locations outside of the park. Geologic resource impacts would affect about 2.6 acres of previously undisturbed upland area and the direct and indirect impacts would be minor.

Cumulative Impacts: Previous impacts to geological resources have occurred along the park road and entrance area, primarily from the removal of mineral materials to construct the park road and other park facilities (see Table 4.3). Numerous borrow sites occur along the road corridor, many of which have become overgrown with native vegetation. Past placer mining in the Kantishna Hills and related access impacted up to 1,500 acres of area. Non-renewable gravel would be removed from about 2.6 acres of area in the next ten years with this alternative. The total impacts of the past, present, and proposed mining operations would be moderate to geological resources.

Conclusion: Alternative 3 would create the potential for negligible off-site impacts involving slope stability, erosion or permafrost and would have no measurable effect on the integrity of other geologic resources within the park. About 110,000 cy of gravel would be permanently removed from a small geographic area (2.6 acres), leading to a moderate impact to geological resources along the park road corridor. Alternative 3 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 4: Phased Development of Moderate Number of Sites *(NPS Preferred)*

Gravel extraction activities at six locations within the park would result in consumption of up to approximately 330,000 to 360,000 cy from in-park resources, the same volume as estimated for Alternative 2. Non-renewable gravel would be reduced by about 200,000 cy from about 3.3 acres of undisturbed upland area and 42 acres of previously disturbed mining claims. Alternative 4 would also consume 12,500 cy of material from gravel sources outside of the park, which would represent a minimal quantity relative to the total supply available in river valley locations outside of the park. Potential off-site impacts involving slope stability, erosion and permafrost for Alternative 4 would be

very similar to those discussed previously for Alternative 2. The overall direct and indirect impacts would be moderate.

Cumulative Impacts: Previous impacts to geological resources have occurred along the park road and entrance area, primarily from the removal of mineral materials to construct the park road and other park facilities (see Table 4.3). Numerous borrow sites occur along the road corridor, many of which have become overgrown with native vegetation. Past placer mining in the Kantishna Hills and related access impacted up to 1,500 acres of area. Non-renewable gravel would be removed from about 3.3 acres of area in the next ten years with this alternative. The total impacts of the past, present, and proposed mining operations would be moderate to geological resources.

Conclusion: Alternative 4 would create the potential for negligible off-site impacts involving slope stability, erosion or permafrost and would not be likely to have a measurable effect on the integrity of geologic resources within the park. Because about 200,000 cy of non-renewable gravel would be removed from a small geographic area, the overall level of impacts to geologic resources under Alternative 4 would be moderate. This alternative would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

Gravel extraction activities at six locations within the park would result in consumption of up to approximately 330,000 to 360,000 cy from in-park resources, the same as estimated for Alternative 2 or 4. Non-renewable gravel would be reduced by up to 200,000 cy. Alternative 5 would also consume 12,500 cy of material from external gravel sources, which would represent a minimal quantity relative to the total supply available in river valley locations outside of the park. Potential off-site impacts involving slope stability, erosion and permafrost for Alternative 5 would be very similar to those discussed previously for Alternative 2 or 4. The overall direct and indirect impacts would be moderate.

Cumulative Impacts: Previous impacts to geological resources have occurred along the park road and entrance area, primarily from the removal of mineral materials to construct the park road and other park facilities (see Table 4.3). Numerous borrow sites occur along the road corridor, many of which have become overgrown with native vegetation. Past placer mining in the Kantishna Hills and related access impacted up to 1,500 acres of area. Non-renewable gravel would be removed from about 3.2 acres of area in the next 10 years with this alternative. The total impacts of the past, present, and proposed mining operations would be moderate to geological resources.

Conclusion: Alternative 5 would create the potential for negligible off-site impacts involving slope stability, erosion or permafrost and would not be likely to have a measurable effect on the integrity of geologic resources within the park. About 200,000 cy of non-renewable gravel would be removed from a small geographic area. The overall level of impacts to geologic resources under Alternative 5 would be moderate and would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

HYDROLOGY, WATER QUALITY AND AQUATIC RESOURCES

Site-Specific Hydrologic Conditions

Toklat River

The Toklat River drains a mountainous, 100-square-mile watershed on the north side of the Alaska Range. Several large glaciers feed the river and cover approximately 2 percent of the watershed area. The Toklat River gravel extraction site is 19 miles upstream from the nearest park boundary. The river has a braided channel in the project area, typical of streams that are transport limited (Ritter 1978). Multiple anastomosing channels are present, and the location of active channel changes seasonally and annually. Stream banks are irregular and poorly defined. The active floodplain is approximately 1,200 to 1,800 feet wide. It is composed predominantly of gravel-sized material with occasional cobbles and boulders. The floodplain is at its narrowest where the proposed extraction site is located. The riverbed has a gradient of 1.5 percent in the reach where gravel extraction is proposed.

Abandoned channels are interlaced throughout the active floodplain, with gravel bars present at various heights between the channels. Typical of glacially fed braided streams, the Toklat carries a large amount of suspended sediment and bed load (coarse sediment carried along the channel bottom, rather than in suspension). The high concentration of suspended sediment during the summer makes the water milky in appearance. The estimated average discharge for the Toklat River is 344 cubic feet per second (cfs). The 1.5-year flood was estimated at 1,324 cfs. The average annual bed load discharge at the proposed gravel removal site was estimated at 222,000 cubic yards (cy) per year (Emmett 2000).

East Fork Toklat River

The East Fork Toklat River drains a 77-square-mile watershed on the north side of the Alaska Range that is similar to the main Toklat River basin. Upstream of the study site are five sub-basins, all of which are fed by glaciers. The tributaries from these sub-basins join to from the main stem just upstream from the East Fork Bridge. The East Fork is a tributary of the Toklat River; their confluence is about 20 miles north of the park road.

Like the Toklat River, the East Fork River is a braided stream. The East Fork River occupies a bed that is up to 2,000 feet wide; this gravel drainage course contains the active channels carrying the stream flow. The streambed is composed of gravel-sized material with occasional cobbles and boulders. Abandoned channels criss-cross the drainage course with intervening gravel bars (interfluves). Typical of glacier-fed streams in mountainous terrain, the East Fork River carries a large amount of suspended sediment and bed load. The large amount of suspended fines causes the water to be milky in appearance during the melt season. Before the glaciers begin to melt in the spring and after freeze-up in the fall, river water is clear. The river has a gradient of 1.2 percent in the reach where gravel extraction is proposed.

The estimated bankfull discharge of the East Fork River is 1,000 cfs and the average annual bed load discharge is approximately 108,000 cy (Emmett 2000). Based on advice from research hydrologists and years of excavation experience at the Toklat River site, the NPS previously decided to limit annual excavation of gravel from active alluvial sites to 5 percent of the annual bed load discharge. For the East Fork River, the 5 percent limit is 5,400 cy per year (Emmett 2002).

Moose Creek/Downtown Kantishna

The Downtown Kantishna site is on the west bank and floodplain of Moose Creek, beginning just downstream from the Kantishna Roadhouse, and extending down river almost to the Denali Backcountry Lodge. Laterally, it extends west across the floodplain, from ordinary high water at the Moose Creek channel to a parallel drainage roughly 850 feet away. The length of the site is approximately 3,700 feet and it is approximately 55 acres in size. Eldorado Creek drains a portion of the Kantishna Hills, a low range west of the site. Moose Creek drains a large area east of the proposed gravel extraction site. Although the majority of the basin is of relatively low relief, Moose Creek does drain portions of the eastern Kantishna Hills. No glaciers are present in either drainage basin; hence, Moose Creek is quite different from the Toklat and East Fork Rivers.

This site itself has been substantially disturbed by mining and related development activities in the past 50 years. As part of this historical disturbance, the mouth of Eldorado Creek and the lowermost 1,000 feet of its channel have been moved from their original locations.

Hydrology Impact Variables

The primary criterion for determining the significance of the potential effects on hydrology is whether implementing the GAP would cause substantial changes to the sediment load or channel patterns of a stream. An extensive study by the U.S. Fish and Wildlife Service (Follman 1980) indicates that one of the main effects of gravel extraction on braided streams is to increase the number of channels. Follman (1980) looked at six braided rivers in subarctic Alaska, and at two main types of excavation: shallow excavation (2 to 3 feet) and deep pits (up to 50 feet). He found that the increase in number of channels, an indicator of channel instability, was accompanied by a tendency toward flow diversion out of the main channel. Additionally, Follman (1980) found effects on channel configuration, hydraulic geometry, sedimentation, ice characteristics and hydrology.

Although the channel configuration is one of the variables most likely to change following gravel removal, Follman (1980) observed that braided channels show the least amount of change in this regard, mainly because they already consist of unstable, multiple channels. Changes in hydraulic geometry include changes to the width, depth, velocity, and conveyance volume. Changes to hydraulic geometry are important mainly because they imply potential for change in physical parameters of streams, such as planform and cross-sectional area. Changes in sedimentation, mainly related to changes in the hydraulic geometry, included changes in sediment size distribution. Sediment size typically decreases after gravel removal, owing to the decrease in velocity at the mined area.

Ice characteristics can change dramatically as a result of gravel mining. The primary mechanisms are ice jamming and aufeis formation. Aufeis forms when water is forced to the surface from underneath ice covering a stream. Successive flows build upon each other, forming a raised surface. Both ice jamming and aufeis can be affected by the widening of a channel, followed downstream by a reduction in width and/or depth, obstructions in the floodplain or relocation of a channel. Follman (1980) noted that these changes are more likely to occur in single channel, sinuous, or meandering streams than in braided streams.

Changes to hydrology can occur through surface flow converting to subsurface flow. This happens when the surface flow is lost to intra-gravel flow in the mined area. Notably, this occurred in only 2 of 25 sites studies by Follman (1980), neither of which was a braided stream.

The literature contains several sources of useful guidelines for minimizing the hydrologic effects of in-channel gravel extraction. Joyce and others (1980) discuss guidelines for removal of gravel from braided streams in subarctic Alaska. Their guidelines are summarized as follows:

- The active channel should not be mined;
- Gravel should be scraped, and should not be scraped to a level lower than the summer low-flow level;
- Scraping should be conducted in a way that minimizes the chance of flow diversion through the mined area;
- Vegetated islands, especially mid-channel "islands," should not be disturbed;
- The general configuration of the channel should be maintained;
- Exposed deposits in the active floodplain should be selected for gravel removal, over vegetated terraces; and
- Excavation pits should only be considered when amounts of gravel greater than 50,000 cubic meters are needed.

In addition, Follman (1980) presents several recommendations with regard to gravel mining in subarctic streams:

- "Small" rivers should not be mined;
- Braided rivers are preferable to other types of rivers (e.g., sinuous, meandering);
- Pit excavations should be located on terraces or the inactive floodplain;
- Gravel operations in the active floodplain should not disturb the edge of the active channel;
- Excavation sites should mimic high-water channels;
- The bed slope of the gravel removal area should be similar to the natural active channel slope;
- Excavations should be configured for proper drainage;
- Stockpiles, overburden piles, and dikes should be located away from active channels; and
- Excavation sites should be located well away from low-flow channels.

Similar studies have been conducted on specific potential gravel sources within the park. Karle (1989) determined that, given the appropriate quantity and style of extraction, gravel could be removed without significant alterations to the floodplain. More recent work has indicated that the amount of gravel that can be extracted without detrimental effects may be somewhat more than previously thought (Emmett 2002). The National Park Service (1990) originally concluded that 7,500 cy of gravel could be excavated without significantly altering the Toklat River channel. Based on a revised estimate of the bed load, Emmett (2000) concluded that 11,100 cy could be extracted each year without affecting the channel.

The procedures currently employed by the NPS for gravel extraction are not entirely consistent with the guidelines recommended by Joyce and others (1990) and Follman (1980b). The analysis done by Karle (2002) states "Excavation would proceed downstream to upstream. The final scrape would open the excavated mirror channel to flow from the natural channel. The flow diversion into the new mirror channel should consist of approximately half the total channel water discharge." This procedure differs from the research guidelines listed above, which maintain that 1) flow diversion should be avoided; 2) the edge of the active channel should not be disturbed; and 3) scraping should not go below the depth of the low-water channel. According to the earlier literature, the proposed procedure could cause significant changes to channel form locally. However, the mirror-channel cut procedure has been used by the NPS

for several years without substantial changes to the Toklat River floodplain. It is likely that, due to the wide expanse of channel and high bedload flux, the alterations to individual channels (such as localized aggradation) are rapidly attenuated. Therefore, long-term effects would be minimal in degree and extent.

Impacts By Alternative

Alternative 1: No Action

Under this alternative, gravel excavation at the Toklat River site would continue at the present rate of 7,500 cy per year. Based on the estimates of Karle (1989) and Emmett (2000), this would not be likely to modify the sediment load or channel patterns upstream or downstream. This amount of gravel extraction is much less than the recommended maximum amount of 11,100 cy per year. Additionally, monitoring conducted during recent years indicated no changes in channel cross-section or pattern that were out of the normal variation of braided rivers (Emmett 2002). The impacts of this alternative to stream hydrology would be negligible.

Cumulative Impacts: Cumulative impacts of placer mining in the Kantishna Hills were evaluated in the mining EIS (NPS 1990) and past effects were determined to be major. Since that time, the NPS has restored about half of the affected stream areas. The NPS plans to restore the Downtown Kantishna area regardless if gravel is removed from the site. Replacement of the Toklat River bridge is the only other human activity with the potential for altering the hydrology of a river. The existing causeway has backed up water and caused upstream deposition of gravel. Based on the recent monitoring results, the additive effects of Alternative 1 would result in little or no change. The overall cumulative effects with this alternative would be moderate.

Conclusion: Alternative 1 would result in negligible direct, indirect and/or cumulative impacts to stream hydrology and would not be likely to have a measurable effect on the integrity of stream resources within the park. The overall level of hydrology impacts under Alternative 1 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 2: Maximum Flexibility/Short Hauls

This alternative would include gravel extraction at both the Toklat and East Fork Rivers. However, because the amount extracted would remain within the 5 percent threshold recommended by Emmett (2000) and Karle (2002) as sustainable, and for the reasons discussed above, little or no effects on channel cross section or planform would be expected and potential hydrology impacts would be negligible. The amount of gravel extraction on the Toklat would be 50 percent higher per year than previously thought to be the maximum sustainable amount. This represents a somewhat higher risk of channel planform and/or cross sectional change. Continued monitoring is called for under the proposed action; should significant channel change occur on either river, the extraction operations could be altered to minimize the effects.

This alternative also includes extensive excavation and regrading at the Downtown Kantishna site. Specific restoration plans for the site are not available at the time of this writing, but conceptual reclamation and mitigation plans are discussed in a separate, recent report (Karle, 2003) prepared for the NPS (included in Appendix C.) This analysis addresses these plans and options for controlling sedimentation, maintaining channel stability, and minimizing floodplain impacts. The report discusses measures to be taken concerning Eldorado Creek, Moose Creek, the extraction area itself, and the options for a bridge across Moose Creek. When followed up with site-specific hydrologic, hydraulic

and geomorphologic study, long-term effects to the floodplain and local hydrology and hydraulics could be minimized through the implementation of these measures.

Cumulative Impacts: As discussed above for Alternative 1, past placer mining impacts would continue to have moderate effects. Little to no change to stream hydrology at the East Fork and Toklat River sites would be expected. . Alternative 2 would result in the restoration of natural stream hydrology conditions at the Downtown Kantishna site, and therefore would reverse the adverse hydrologic effects from historical mining operations. Consequently, Alternative 2 would result in little additive effect, but the overall cumulative impact to hydrology would be moderate.

Conclusion: Alternative 2 would result in negligible direct and indirect impacts to stream hydrology (including likely positive effects at Downtown Kantishna) and would not be likely to have a measurable effect on the integrity of stream resources within the park. The overall level of hydrology impacts under Alternative 2 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 3: Minimum Visual Intrusion/Long Hauls

Under this alternative, gravel excavation at the Toklat River site would increase to an extraction rate of 11,100 cy per year. Based on the estimates of Karle (1989) and Emmett (2000), this would not be likely to modify the sediment load or channel patterns upstream or downstream. This amount of gravel extraction is up to the recommended maximum amount of 11,100 cy per year. Monitoring conducted during recent years indicated no changes in channel cross-section or pattern occurred when 7,500 cy per year were extracted from the Toklat River (Emmett 2002). The impacts of this alternative to stream hydrology would be negligible.

Cumulative Impacts: Cumulative impacts of alternative 3 would be similar to the cumulative impacts for Alternative 1. Based on the recent monitoring results, the additive effects of Alternative 3 would result in little or no change to hydrologic functions. The overall cumulative effects with this alternative would be moderate.

Conclusion: Alternative 3 would not have a measurable effect on stream resources within the park and would result in negligible direct and indirect impacts to stream hydrology. The overall level of hydrology impacts under Alternative 3 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 4: Phased Development of Moderate Number of Sites *(NPS Preferred)*

This alternative includes in-channel gravel extraction at the Toklat River and East Fork River sites. Gravel extraction would also occur at the Downtown Kantishna site under this alternative. The measures discussed by Karle (2003) would minimize the temporary adverse effects on the hydrology, hydraulics, and geomorphology of the site and associated streams, while restoration of more natural stream channel conditions would likely improve the local hydrology on a long-term basis. For the reasons stated under Alternatives 1 and 2 above, effects on hydrology at these sites would be negligible.

Cumulative Impacts: As discussed above for Alternative 1, past placer mining impacts would continue to have moderate effects. Little to no change to stream hydrology at the East Fork and

Toklat River sites would be expected. Restoration of natural stream hydrology conditions at the Downtown Kantishna site would reverse the adverse hydrologic effects from historical mining operations. Consequently, Alternative 4 would result in little additive effect, but the overall cumulative impact to hydrology would be moderate.

Conclusion: Alternative 4 would result in negligible direct and indirect impacts to stream hydrology (including likely positive effects at Downtown Kantishna). The overall level of hydrology impacts under Alternative 4 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

This alternative includes gravel extraction at the Toklat River, East Fork River and Downtown Kantishna sites. The impacts would be negligible to hydrological resources, and would be the same as described for Alternative 4.

Cumulative Impacts: Overall cumulative impacts would be moderate, and would be the same as discussed for Alternative 4.

Conclusion: Alternative 5 would result in negligible direct and indirect impacts to stream hydrology (including likely positive effects at Downtown Kantishna.) The overall level of hydrology impacts under Alternative 5 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Water Quality

Roads have been associated with accelerated turbidity. One of the main causes of increased turbidity is “pumping” of fines from the subgrade through road surfacing (Reid and Dunne 1984). Surfacing of a road is critical to preventing or at least minimizing increased turbidity in road surface runoff. Each year, between June and September, approximately 5,700 bus trips take place along the full length of the park road. This is enough to place the road in the “main line” category (highest use) characterized by Reid and Dunne (1984). There have been no studies of road surface runoff in Denali National Park. The park road surface is generally well maintained and, given the generally high quality of water in the park, it is unlikely that the park road has increased turbidity in park streams. Glacier-fed streams in the park tend to be relatively turbid, especially during warm weather and high runoff rates, and non-glacial streams such as Moose Creek are known to run turbid after heavy rains or spring runoff events.

The primary criterion for evaluating the potential of each GAP alternative to affect water quality is the potential to elevate turbidity in streams. This could occur due to runoff from excavated areas, or from the park road itself. One measure by which to judge the risk of surface erosion is to compare the amount of surface area disturbed in each alternative. Table 4.2 previously showed the total surface area of disturbance, over the 10 years for which the plan would be applicable, by alternative. Note that some sites, depending on alternative, would be restored within the plan period. The total area of new disturbance within the park would range from approximately 1 acre under Alternative 1 to nearly 5 acres under Alternative 2. In addition, Alternatives 2, 4 and 5 involve mining and restoration on approximately 42 previously disturbed acres at the Downtown Kantishna site. In comparison, the existing area disturbed by the park road is approximately 335 acres, and the total area of existing surface disturbance within the road corridor is approximately 525 acres (see Table 4.3).

Another way in which elevated turbidity could occur is through excavation of the channels at the in-river sites, alteration of the floodplain, and secondary erosion. Alternatives can be compared by how much instream activity would be allowed, and how each would specifically mitigate for the effects of gravel mining.

The amount of gravel hauling between source sites and where the gravel is needed would affect road usage and thus the potential for sediment delivery through road surface runoff. However, compared to the current amount of bus and administrative traffic, which would be the same under all alternatives, the effect of differences in hauling mileage between alternatives would be minor (as discussed initially under Air Quality).

Alternative 1: No Action

This alternative would rely heavily on external sources for gravel (see Table 2.1). The external sources are not as well defined as the in-park sources. To make a comparison to the surface disturbance of in-park sources, the ratio of average surface area to volume of deposit for the in-park sources was calculated and applied to the estimated volume to be obtained from external sources under this alternative. The total disturbance area includes an estimated 34 acres of external disturbance and only 1 acre of disturbance within the park, at the Teklanika Pit (primarily) and the North Face Corner Pit. The total area of new surface disturbance within the park is the least among the five alternatives, although the estimated 34 acres of surface disturbance at external source sites is the largest among the alternatives by a considerable margin. While it is difficult to estimate potential erosion at external gravel sources without site-specific mining plans, several factors contribute to a low probability of erosion.

First, there is a short amount of time during which erosion can occur. The ground remains snow-free for only about 4 months in the project area. This automatically restricts the potential for erosion. Additionally, most gravel deposits tend to have a relatively coarse median grain size—usually larger than sand. Because silt and sand are the most mobile particles, the nature of the deposits themselves would limit the amount of possible erosion. For example, the erosion hazard for a soil designated as a "likely" gravel source in the nearby Kantishna area (Brannan and Swanson 2001) had a "slight" erosion hazard. Thirdly, delivery of eroded sediment requires a direct surface water connection between the gravel pit and a stream. Best management practices typically used in gravel extraction require that the gravel pit have internal drainage, rather than allow runoff to leave the site.

The effects of the road itself on water quality would be the similar under all alternatives, because the same levels of maintenance would be required (i.e. the same amount of surfacing would be maintained). A minor amount of fine sediment would be generated by traffic and runoff during rainstorms on the park road. However, the effect is not likely to be significant, for several reasons. Reid and Dunne (1984) found that effects of road surface erosion in a watershed on the Olympic Peninsula of Washington State were noticeable when road densities approached 2 or 3 percent. Without calculating the road density within Denali National Park, it can be seen on the maps presented in Chapter 1 that there is a very low road density. In most of the watersheds in the park in which there are any roads, the park road is the only road. Furthermore, the length of the park road within each major watershed is relatively short, because the watersheds are oriented in a north-south direction and the road traverses them east to west. Additionally, many of the north-side streams have elevated levels of turbidity naturally, due to their glacial sources. Therefore, any effect of the road itself is likely to be small relative to background turbidity.

River gravel extraction would occur on the Toklat River, at a rate of no more than 7,500 cy of gravel per year. This would not be expected to increase turbidity on a consistent basis, although short-term increases could occur when the "mirror" channels are connected to the active channels. A short-lived increase in turbidity would occur during the initial flows through these excavated channels, as the fine sediment on the channel bottom was winnowed out by the flow. The turbidity would rapidly approach background levels, however, as the amount of fines available for entrainment dropped.

Based on the limited area of surface disturbance and the required use of best management practices, potential impacts from Alternative 1 on water quality would likely be negligible (little or no change to existing conditions); at most, there would be short-term and localized changes that would represent a minor impact level.

Cumulative Impacts: When considered in the context of existing stream turbidity patterns and the extent of existing surface disturbance within the road corridor, the cumulative impacts on water quality would be negligible.

Conclusion: Alternative 1 would result in negligible direct and indirect impacts to water quality. The overall level of water quality impacts under Alternative 1 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 2: Maximum Flexibility/Short Hauls

Alternative 2 would result in new surface disturbance on 4.6 acres of land within the park, which is more than any other alternative. Alternative 2 would also involve gravel mining and reclamation on approximately 42 acres of previously disturbed area at the Downtown Kantishna site, and a small area of new disturbance at external source sites. This alternative would still have a low risk of affecting water quality through increased turbidity. The mitigation required by NPS regulations, and the reclamation of the Downtown Kantishna site, would minimize the potential for water quality degradation. Primary mitigation would be in gravel pit design; as mentioned above, drainage would be internal until the site was restored.

Most of the gravel extraction sites are small and relatively scattered along the park road corridor. While the Downtown Kantishna site covers 55 acres, only an estimated 42 acres would be disturbed for gravel extraction and reclamation, the report produced by Karle (2003; see Appendix C) outlines potential mitigation and reclamation procedures that would be carried out at this site. These procedures would minimize the risk of water quality impacts.

River gravel extraction would occur on the Toklat River (110,000 cy) and East Fork River (54,000 cy) over the course of 10 years. While more gravel would be taken from the rivers in Alternative 2 than under Alternative 1, this would increase turbidity for a short duration over a short reach of the rivers, as discussed under Alternative 1. Based on the limited area of surface disturbance and the required use of best management practices, potential impacts from Alternative 2 on water quality would likely be minor.

Cumulative Impacts: When considered in the context of existing stream turbidity patterns and the extent of existing surface disturbance within the road corridor, the cumulative impacts on water quality would likely be minor.

Conclusion: Alternative 2 would result in minor direct and indirect impacts to water quality. The overall level of water quality impacts under Alternative 2 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 3: Minimum Visual Intrusion/Long Hauls

The amount of land disturbed under this alternative would be less than any of the other action alternatives; approximately 21 acres would be disturbed over 10 years, including about 2.6 acres within the park. For the reasons described for Alternatives 1 and 2 (the coarse nature of deposits, a limited window for erosion, and the mitigation required), short-term effects to water quality over short stream reaches from the surface disturbance would be expected. The effects from in-channel excavation at the Toklat River would the same as described under Alternative 2; effects on water quality would be minor.

Cumulative Impacts: When considered in the context of existing stream turbidity patterns and the extent of existing surface disturbance within the road corridor, the cumulative impacts on water quality would be minor.

Conclusion: Alternative 3 would result in minor direct and indirect impacts to water quality. The overall level of water quality impacts under Alternative 3 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 4: Phased Development of Moderate Number of Sites *(NPS Preferred)*

Under this alternative, approximately 47 total acres of land would be disturbed over 10 years. Most of this disturbance would occur at the Downtown Kantishna site (42 acres), and would involve mining and reclamation activity on land that was disturbed by placer mining during the1970s and early 1980s. Consequently, Alternative 4 would involve only 5 acres of new surface disturbance, including 3.1 acres within the park. Because mitigation and restoration would be the same as Alternative 2 while the area of surface disturbance would be slightly less, the effects on water quality from surface disturbance would be similar to but slightly less than those under Alternative 2. In-channel gravel mining would also occur at the Toklat and East Fork Rivers, with projected extraction volumes somewhat less than under Alternative 2. The effects would also be essentially the same, in that there would be minor (small, temporary) effects on water quality from in-channel excavation at these sites. Potential impacts from Alternative 4 on water quality would be somewhat less than those identified for Alternative 2, which would be minor.

Cumulative Impacts: When considered in the context of existing stream turbidity patterns and the extent of existing surface disturbance within the road corridor, the cumulative impacts on water quality would likely be minor.

Conclusion: Alternative 4 would result in minor direct and indirect impacts to water quality. The overall level of water quality impacts under Alternative 4 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 5: Economic Alternative with Moderate Hauls (NPS Preferred)

Alternative 5 is virtually the same as Alternative 4, except that phase 2 of source site development in the western end of the road corridor would involve the North Face Corner site in place of the Moose Creek Terrace site. The area of new surface disturbance, mining and reclamation on previously disturbed sites and in-channel gravel extraction would be virtually the same, and would result in the same level of impacts identified for Alternative 4. Therefore, potential impacts from Alternative 5 on water quality would be minor.

Cumulative Impacts: When considered in the context of existing stream turbidity patterns and the extent of existing surface disturbance within the road corridor, the cumulative impacts on water quality would be minor.

Conclusion: Alternative 5 would result in minor direct and indirect impacts to water quality. The overall level of water quality impacts under Alternative 5 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Aquatic Resources

Impact issues related to fisheries and other aquatic resources include (1) the potential for gravel operations to cause direct disturbance of aquatic habitat in water bodies and (2) the potential for indirect effects to aquatic habitat through changes in hydrology and/or water quality.

Among the 10 candidate gravel extraction sites evaluated in this EA, physical proximity to water bodies at 6 of the sites suggests a potential for aquatic effects. The East Fork and Toklat River sites are within the floodplains of the respective rivers, and operation of these sites would involve in-channel mining activity. Similar circumstances apply to the Downtown Kantishna site, where excavation and processing would occur within the floodplain of Moose Creek and Eldorado Creek and the stream channels would be modified through operation and reclamation. The Beaver Pond site is near an unnamed tributary of the Thorofare River. The Moose Creek Terrace site is within a short distance of Moose Creek and the North Face Corner site is within a similar distance of Moose Creek, indicating that the potential for indirect aquatic effects through hydrologic and/or water quality changes needs to be considered for these sites. The remaining four candidate sites (Teklanika Pit, Boundary, Camp Ridge, and Kantishna Airstrip) are located a sufficient distance from water bodies capable of providing aquatic habitat that that there should be minimal potential for aquatic resource impacts near these sites.

Prior evaluation of gravel operations at the Toklat River site concluded that significant impacts to aquatic resources would not occur (NPS 1999). The abrasive bedload and constant channel changes during most of the summer prevent development of significant aquatic resources in the affected reach of the stream. The Toklat River in this area does not support a fishery, although Arctic grayling have been observed moving through the area in small numbers in the early fall, when sediment loads are lower and water clarity (preferred by grayling) is greater. Because the physical and habitat characteristics of the East Fork River are very similar to those of the Toklat River, the conclusion of insignificant potential effects on aquatic resources is likewise applicable to gravel operations at the East Fork site.

Moose Creek is a generally clear, non-glacial or precipitation-fed stream that is known to be used in various reaches by grayling, round whitefish, slimy sculpin, northern pike and three species of salmon. Mining and reclamation plans for the Downtown Kantishna site would include in-water

activity that would temporarily disturb aquatic habitat in the affected reach of the creek. Instream habitat would presumably be restored and likely even improved (primarily in Eldorado Creek) on a long-term basis through the reclamation objectives identified for the site. The mining and reclamation plans that are currently available are not sufficiently detailed to allow a thorough evaluation of the potential impacts. For example, one of the key project features with the potential for effects on aquatic species and habitat is construction of the proposed bridge across Moose Creek, but detailed plans concerning location, characteristics and construction methods for the bridge have not yet been defined. The plans available at this time (see Appendix C) do provide information concerning stormwater management, stream bank stabilization and similar measures that are relevant to the likelihood and possible extent of hydrologic and/or water quality changes that could affect aquatic habitat in the creeks.

The boundary of the proposed Moose Creek Terrace operating area is approximately 100 feet from the banks of Moose Creek at the closest point, so there would be no in-channel disturbance of aquatic habitat in the creek as a result of mining operations. The pit would intercept some groundwater flow and intermittent surface flow from heavy rains and spring snowmelt. Because the substrate has a good infiltration capacity and the drainage area uphill from the pit is relatively small, flow interception should not result in significant changes to local hydrology. Stormwater would be contained within the pit area rather than discharged to the creek and erosion and sedimentation control measures would be employed to prevent sediment or contaminant discharge to the creek. Consequently, the site operating plans should be sufficient to avoid any significant water quality effects in the adjacent reach of Moose Creek. Based on a lack of expected hydrologic or water quality changes, operation of the Moose Creek Terrace site would not be likely to create indirect impacts on aquatic habitat in the creek.

Each alternative that includes Downtown Kantishna would likely result in beneficial effects on the aquatic resources of Eldorado Creek from the restoration actions that are part of the site plans.

Alternative 1: No Action

Previous NPS environmental assessments concluded that gravel extraction, processing, and storage activities at the Teklanika Pit, Toklat River, and North Face Corner sites would not cause significant impacts to aquatic resources near those sites. Based on the prior documentation and the previous conclusions with respect to hydrology and water quality, potential aquatic habitat effects of Alternative 1 would be negligible and current aquatic habitat conditions in the park would continue for the foreseeable future.

Cumulative Impacts: The EIS evaluating cumulative impacts of mining in the Kantishna Hills, including tributaries to Moose Creek, indicated past placer mining activities had a major impact on aquatic habitat (NPS 1990). The NPS has since restored several miles of aquatic habitat after acquiring mining claims in the area, and plans are be developed to continue placer claim reclamation in disturbed areas of the Kantishna Hills. The additive effects of the no-action alternative to aquatic habitat in the Toklat River would be inconsequential, and the overall cumulative impacts from placer mining to aquatic habitat are judged now to be moderate.

Conclusion: Alternative 1 would result in negligible direct and indirect impacts to aquatic habitat. The overall level of aquatic resource impacts under Alternative 1 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 2: Maximum Flexibility/Short Hauls

Continued or expanded gravel extraction, processing and storage activities at the Teklanika Pit, Toklat River and North Face Corner sites would cause little or no change to aquatic resources near those sites, for the reasons discussed under Alternative 1. Development of a new in-channel mining operation at the East Fork River would involve the same characteristics as at the Toklat River, and would result in short-term effects to aquatic resources a short distance below the extraction area. New mining operations at four other sites along the park road corridor (Beaver Pond, Boundary, Camp Ridge and Kantishna Airstrip) would not cause direct or indirect changes to water bodies and would result in little or no change to aquatic resources.

Alternative 2 includes mining and reclamation of the Downtown Kantishna site. While the Downtown Kantishna site covers 55 acres, about 42 acres of previously disturbed land would be affected under this alternative. Based on the mitigation procedures identified in the recent reclamation plan developed for this site (Karle 2003; see Appendix C), gravel extraction and reclamation at this site could be performed in a manner that would minimize the risk of short-term water quality and aquatic habitat impacts. Restoration of the channels and aquatic habitats in Moose and Eldorado Creeks at this site would likely result in positive long-term impacts for aquatic resources.

Given the site development, mitigation and monitoring procedures adopted by the NPS (see discussion in Chapter 2), the overall direct and indirect effects of Alternative 2 on aquatic resources in the park would be minor.

Cumulative Impacts: Any adverse cumulative impacts at East Fork and Toklat Rivers would likely be at most minor, and the potential to reverse some of the historic impacts to aquatic habitats in Eldorado and Moose Creeks at the Downtown Kantishna site would result in net positive cumulative impacts from Alternative 2. The overall persistent impacts to aquatic resources from former placer mining impacts would remain moderate.

Conclusion: Alternative 2 would result in minor direct and, impacts to aquatic habitat. The overall level of aquatic resource impacts under Alternative 2 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 3: Minimum Visual Intrusion/Long Hauls

Continued and/or expanded gravel extraction, processing and storage activities at the Teklanika Pit and Toklat River sites would cause short-term impacts to aquatic resources near those sites, as discussed for Alternative 1. New mining operations at Moose Creek Terrace would not cause direct or indirect changes to Moose Creek and would result in little or no impacts to aquatic resources in the creek. Overall, the potential for effects on aquatic habitat among the four action alternatives would be least for Alternative 3 and would be negligible.

Cumulative Impacts: The cumulative impacts under Alternative 3 would be similar to those described for alternative 1. The additive effects of Alternative 3 to aquatic habitat in the Toklat River would be inconsequential, and the overall cumulative impacts to aquatic habitat from past effects of placer mining in the Kantishna area would remain moderate.

Conclusion: Similar to the discussion for Alternative 1, Alternative 3 would result in negligible direct and indirect impacts to aquatic habitat. The overall level of aquatic resource impacts under

Alternative 3 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 4: Phased Development of Moderate Number of Sites (*NPS Preferred*)

The potential for impacts to aquatic resources under Alternative 4 would be essentially the same as for Alternative 2. Effects on aquatic habitat at or near the Teklanika Pit, East Fork, Toklat River, Beaver Pond and Moose Creek Terrace would result in short term, localized or no change to aquatic resources near those sites. The potential aquatic impacts resulting from in-channel disturbance and changes to hydrology and water quality at the Downtown Kantishna site is likewise expected to be short-term, localized, and ultimately positive, based on implementation of the mitigation and reclamation procedures identified by Karle (2003). The overall direct and indirect effects on aquatic resources would be minor under Alternative 4.

Cumulative Impacts: Cumulative impacts to aquatic resources with Alternative 4 would be the same as described for Alternative 2. Alternative 4 would result in minor additional effects in East Fork and Toklat Rivers and positive changes at Eldorado and Moose Creeks near Downtown Kantishna, but overall persistent impacts to aquatic resources from former placer mining impacts would remain moderate.

Conclusion: Alternative 4 would result in minor direct and indirect impacts to aquatic habitat. The overall level of aquatic resource impacts under Alternative 4 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

The impacts to aquatic resources under Alternative 5 would be essentially the same as for Alternative 4 (or Alternative 2) and would be minor overall.

Cumulative Impacts: Would be the same as for Alternative 4 (and Alternative 2) and would be moderate overall due to ongoing effects from former placer mining.

Conclusion: Alternative 5 would result in minor direct and indirect impacts to aquatic habitat. The overall level of aquatic resource impacts under Alternative 5 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

WILDLIFE VALUES AND HABITAT

Site Specific Conditions

All of the specific sites evaluated in this EA have the potential to receive some use by wildlife. As part of the effort to assess impacts of the gravel acquisition plan on wildlife in Denali National Park, NPS staff catalogued wildlife resource concerns within 500- and 1000-meter buffers around each of the proposed gravel extraction and processing sites. These inventoried buffers serve as the primary measure of the types of wildlife that would be affected at each of the sites. In general, extraction and processing activities might disturb wildlife, alter their movement or degrade habitat.

There are currently no federally listed endangered species that occur within Denali National Park. The Alaska Department of Fish and Game (ADF&G) maintains a list of Species of Special Concern. A species of special concern is any species or subspecies of fish or wildlife or population of mammal or bird native to Alaska that has entered a long-term decline in abundance or is vulnerable to a significant decline due to low numbers, restricted distribution, dependence on limited habitat resources, or sensitivity to environmental disturbance (ADF&G website). There are a few species from this list that might be affected by the proposed gravel acquisition plan. These species include: American peregrine falcon, arctic peregrine falcon, olive-sided flycatcher, gray-cheeked thrush, Townsend's warbler, and blackpoll warbler.

Although all of the alternatives have the potential for disturbance to wildlife species and their habitats, most if not all of these disturbances would be negligible. Most of the gravel acquisition activities would occur in areas already disturbed by human activities and therefore, most of the potential impacts to wildlife would have already occurred. Overall, the proposed activities would cause little or no change to wildlife populations or habitats. Any alternative that results in loss of conifer forest would have the greatest impact on nesting birds, as this habitat appears to be most limiting within the affected areas.

Teklanika Pit

No raptor nests were recorded in the Teklanika Pit area by the NPS. Moose density in the area is low (NPS 1992). The site does not contain Dall sheep habitat, and their nearest migration route is on the divide between the Teklanika and Sanctuary Rivers. Individual caribou are seen along the Teklanika flats, but the area is not known as a calving, rutting, or wintering ground. The site does not receive frequent grizzly bear use. The only recently active wolf den in the area is 5 miles away. Bird species possibly nesting adjacent to this site are olive-sided flycatcher, gray-cheeked thrush, and blackpoll warbler. These species would most likely nest in the adjacent white spruce forest. Gravel acquisition activities might cause failure of any nests within the area. Peregrine falcons may hunt in this area but their normal activities would probably not be altered.

East Fork River

There are several species of concern occurring within 1000 meters of this site. Within the 500-meter buffer, merlin and semipalmated plover nests have been observed. The site has been used as a foraging area by grizzly bears and serves as a travel corridor for other wildlife. A golden eagle nest is within the 1000-meter buffer around the proposed site, and a wolf denning area is also in the vicinity. Gray-cheeked thrushes and blackpoll warblers may nest in the adjacent upland habitat and might suffer local loss of brood production due to gravel acquisition activities. Peregrine falcons may hunt in the area but most likely would not be affected by gravel acquisition activities.

Toklat River

The 500-meter buffer around the Toklat River site is used by nesting semipalmated plovers and foraging grizzly bears. Within the 1000-meter buffer golden eagles occur as well as caribou, although primary caribou habitat does not exist in the immediate vicinity of the site (NPS 1992). A Dall sheep nursery is located on the broad ridge east of the site. Wolves have been seen occasionally in the drainage near the Toklat road camp and a wolf den, which is used intermittently is located downstream of the proposed extraction site. Gray-cheeked thrushes and blackpoll warblers may nest in the adjacent upland habitat and might suffer local loss of brood production due to gravel acquisition activities. Peregrine falcons may hunt in the area but most likely would not be affected by gravel acquisition activities.

Beaver Pond

Moose foraging habitat occurs within 500 meters of the proposed site, while beaver dams and lodges and foraging areas are located within 100 meters. No raptor nests were recorded in the vicinity.

Boundary

Moose foraging areas and riparian nesting birds on Lake Creek are of concern for this site. Gyrfalcon and merlin nesting sites, moose foraging area and waterfowl foraging area at the north end of Wonder Lake are within 1000 meters of the site. Olive-sided flycatchers may nest in the adjacent white spruce and might suffer local loss of brood production due to gravel acquisition activities.

Moose Creek Terrace

NPS personnel have observed nesting riparian birds, merlin nests, and moose and grizzly foraging area within 500 meters of the proposed Moose Creek site. Olive-sided flycatchers and blackpoll warblers may nest in the adjacent white spruce forest and riparian habitats. Local loss of brood production might occur as a result of gravel acquisition activities

North Face Corner

Wildlife use at North Face Corner is similar to the Moose Creek Terrace site. Moose foraging occurs within 500 meters of the proposed site. Kingfishers have built their nests in banks at the extraction site. Within 1000 meters of the site, nesting riparian birds and merlin are of concern. Olive-sided flycatchers and blackpoll warblers may nest in the adjacent white spruce forest and riparian habitats. Local loss of brood production might occur as a result of gravel acquisition activities.

Camp Ridge

Both nesting riparian birds and merlin occur within 500 meters of the proposed site extraction site. Camp Ridge is also close to the riparian zone of Moose Creek. Olive-sided flycatchers and blackpoll warblers may nest in the adjacent white spruce forest and riparian habitats. Local loss of brood production might occur as a result of gravel acquisition activities.

Downtown Kantishna

Nesting riparian birds and moose foraging occur within 500 meters of the proposed extraction site, and there is a riparian zone along Moose Creek. No raptor nests have been recorded in the vicinity. Olive-sided flycatchers and blackpoll warblers may nest in the adjacent white spruce forest and

riparian habitats. Local loss of brood production might occur as a result of gravel acquisition activities.

Kantishna Airstrip

The primary concern for this site relates to the riparian zone along Moose Creek, which supports nesting riparian birds within 500 meters of the site. Merlins nest to the north of the strip, within 1000 meters of the site. Blackpoll warblers may nest in the adjacent riparian habitats. Local loss of brood production might occur as a result of gravel acquisition activities.

Alternative 1: No Action

The impacts on wildlife from the Teklanika, Toklat River, and North Face Corner sites were assessed in the EA for the 1992 gravel acquisition plan, a 1999 EA for the Toklat site, and a 1999 EA for gravel acquisition at the North Face Corner. These prior studies found that operations at Teklanika Pit would cause local alteration in migration routes for the small groups of caribou that pass through the Teklanika flats (NPS 1992). Grizzly bear and wolf travel patterns can be a function of caribou utilization in the park road corridor, and thus might be altered as well. Moose travel in the vicinity of the site enroute to nearby habitat, but would not be significantly affected by operations.

The Toklat River floodplain is a travel corridor for grizzly bears and wolves (NPS 1999). The steep slopes to the east and west of the floodplain restrict local movement of these species. Migrating caribou travel past the area 1 or 2 miles upstream of the Toklat extraction site during the summer. Moose in the area are most often seen in the forest on the lower slopes, and not on the gravel bars. Similar local displacement impacts were identified for gravel extraction at the North Face Corner site, where operations could disrupt or shift movements of moose, grizzly bears, wolves and small groups of caribou (NPS 1999). These prior environmental analyses found that the subject operations would result in short-term adverse impacts on wildlife near the extraction sites.

Animal movements are already influenced to some degree by traffic on the park road. Because of findings by Singer and Beattie (1986), the park GMP established vehicle limits to preserve wildlife viewing opportunities. This alternative would result in a 16% increase in vehicle traffic (220,000 dump truck miles), including at night. The additional truck traffic would occur over the entire park road to make up for the dearth of developed gravel resources within the park. The disturbance to wildlife along the park road corridor would be transient but widespread. The direct and indirect impacts of this alternative on the park's wildlife would be moderate.

Cumulative Impacts: Nearly 1.5 million vehicle miles are driven on the park road each summer season, resulting in temporary disturbance to wildlife along the entire park road corridor, and this alternative would add 220,000 dump truck miles. The NPS has developed about 525 acres of former wildlife habitat along the road corridor and about 30 acres has been developed by private lodges in Kantishna. Another several hundred acres were disturbed on mining claims in the Kantishna Hills resulting in major impacts to wildlife habitat (NPS 1990). Some of this impact has been mitigated over the past 10 years with NPS restoration projects on recently acquired mining claims along Glen Creek, Caribou Creek, and Slate Creek. Impacts to wildlife habitat have been reduced and would continue to be reduced in the future with planned restoration projects in Glacier Creek in the Kantishna Hills. Temporary disturbance to wildlife movements along the park road, however, would be increased by 16 % with this alternative, and the overall cumulative impacts to wildlife are judged to be moderate.

Conclusion: Alternative 1 would result in moderate direct and indirect impacts to wildlife values and habitat. The overall level of wildlife resource impacts under Alternative 1 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 2: Maximum Flexibility/Short Hauls

Alternative 2 proposes to develop the greatest number of new sites (six) for gravel operations. Large mammals such as grizzly bears, wolves, caribou, and moose tend to avoid developed areas. These new sites could alter the travel patterns for animals migrating or foraging in the vicinity. However, travel patterns of large mammals are already affected by human activity along the road corridor and in the existing development nodes. With the exception of the Beaver Pond site, all of the sites that would be opened for gravel extraction under this alternative are located near existing developed uses and/or areas of concentrated human activity, particularly the sites in the west end of the road corridor. The incremental increase in disturbance would cause a minor (short-term and localized) change in the ability of large mammals to travel or forage.

Small mammals such as squirrels, shrews, voles, and birds would be displaced to adjacent habitat by activities within the actual extraction and processing sites. The loss of habitat in this manner would be long-term, but would be recovered with restoration of the sites. Alternative 2 would create the greatest area of site disturbance and thus the greatest loss of small mammal and bird habitat. However, the amount of acreage lost as habitat would be quite small (less than 5 acres) and widely distributed when compared to the remaining unaffected area along the road corridor. Consequently, the habitat loss would represent at most a minor reduction to small mammal and bird populations in the park, and it would have little or no effect on the populations of predator species.

This alternative would result in new disturbance on approximately 7 acres of wildlife habitat, including 5 acres within the park, which would be a minor impact to wildlife habitat overall. Truck traffic under this alternative would be about 110,000 miles each summer season or about 7% of the total traffic. This is commensurate with the recent level of truck traffic on the park road, which would be a negligible change from past operations. The overall direct and indirect impact of this alternative on wildlife habitat and values would be minor.

Cumulative Impacts: The past and present impacts to wildlife habitat and values from placer mining and vehicle traffic would be similar to Alternative 1. The effects from 110,000 truck miles and the loss of about 5 acres of habitat over 8 sites would add little additional impact to these resources. The overall cumulative impacts would remain moderate.

Conclusion: Alternative 2 would result in minor direct and indirect impacts to wildlife values and habitat along the park road corridor. The overall level of wildlife resource impacts under Alternative 2 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 3: Minimum Visual Intrusion/Long Hauls

The impacts on wildlife resulting from this alternative would be very similar to those resulting from Alternative 1. Impacts from the Teklanika Pit and Toklat River sites would be the same as described under Alternative 1. Development of the Moose Creek Terrace site would cause temporary displacement of some large mammal movement, although the Moose Creek area is already subject to

some wildlife disturbance through existing human activity. Small groups of caribou that might otherwise move through the site would move up the slope to skirt the operations. Grizzly bears would also skirt around uphill of the operations. Wolves most often hunt in summer as individuals, and these would find easy access through the rest of the width of the Moose Creek Valley. Dall sheep generally do not use the Kantishna Hills and would not be affected. Small mammals, birds, and their predators would be affected in the same manner as described for Alternative 2, although the area of affected habitat would be smaller (2.6 acres of new disturbance within the park). These operations at gravel extraction sites in alternative 3 would result in short-term adverse impacts on wildlife over a small geographic area.

As noted in the discussion for Alternative 1, animal movements are already influenced to some degree by traffic on the park road. This alternative would result in a 12% increase in vehicle traffic (175,000 dump truck miles), including at night. The additional truck traffic would occur mostly over the eastern part of park road to make up for the dearth of developed gravel resources within the park and minimal extraction at Teklanika Pit. The disturbance to wildlife along the park road corridor would be transient and fairly widespread. The direct and indirect impacts of this alternative on the park's wildlife would be moderate, but less than under Alternative 1.

Cumulative Impacts: The past and present impacts to wildlife habitat and values from placer mining and vehicle traffic would be similar to Alternative 1. The effects from 175,000 truck miles and the loss of about 2.6 acres of habitat over 2 sites would add little additional impact to these resources. The overall cumulative impacts would remain moderate.

Conclusion: Alternative 3 would create the potential for moderate direct and indirect impacts to wildlife values and habitat along the park road corridor. The overall level of wildlife resource impacts under Alternative 3 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 4: Phased Development of Moderate Number of Sites (*NPS Preferred)*

Under this alternative extraction and processing activities at the Teklanika Pit and Toklat River would continue. Gravel extraction at the Downtown Kantishna site would occur as a by-product of site reclamation. New extraction activity would take place at the East Fork River, Beaver Pond and Moose Creek Terrace sites. The impacts to wildlife under this alternative include alterations to large mammal movement and minor loss of small mammal and bird habitat and the effects of the loss of those small animals on predator populations, as described for Alternative 2. In this case, only five of the potential extraction sites would be operating simultaneously throughout the year and throughout the life of the plan. A total of 47 acres would be affected by this alternative, including 42 acres of previously disturbed land at former placer mine sites at Downtown Kantishna and 2 acres at external source sites. There would be a direct loss of three acres of habitat inside the park. As concluded for Alternative 2, the direct and indirect effects of this alternative would not appreciably reduce large mammal, small mammal, or bird populations or habitat.

Truck traffic under this alternative would be about 106,000 miles each summer season or about 7% of the total traffic. This is commensurate with the recent level of truck traffic on the park road, which would be a negligible change from past operations. Overall, the impacts to wildlife resulting from this alternative would be minor.

Cumulative Impacts: Similar to Alternative 2, the past, present, and future effects to wildlife habitat and values would be moderate overall. This alternative would contribute slightly less additive impact

than Alternative 2 because 3,000 fewer truck miles are estimated to operate from the extraction sites and only 3.3 acres of habitat would be lost.

Conclusion: Alternative 4 would result in minor direct and indirect impacts to wildlife values and habitat along the park road corridor. The overall level of wildlife resource impacts under Alternative 4 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

The wildlife impacts for this alternative would be nearly identical to those discussed for Alternative 4. The difference between alternatives would be that new impacts on wildlife would occur at North Face Corner instead of Moose Creek Terrace, but the same type and extent of impacts would occur. If belted kingfishers are nesting in the surface of the gravel wall at North Face Corner, gravel acquisition activities should be restricted or suspended until the nesting activities cease.

Truck traffic under this alternative would be about 106,000 miles each summer season or about 7% of the total traffic. This is commensurate with the recent level of truck traffic on the park road, which would be a negligible change from past operations. As concluded for Alternative 4, however, detrimental impacts to wildlife movement or habitat resulting from the incremental disturbance associated with Alternative 5 would be minor.

Cumulative Impacts: Similar to Alternative 2, the past, present, and future effects to wildlife habitat and values would be moderate overall. This alternative would contribute slightly less additive impact than Alternative 2, however, because 4,000 fewer truck miles are estimated to operate from the extraction sites and only 3.2 acres of habitat would be lost.

Conclusion: Alternative 5 would result in minor direct and indirect impacts to wildlife values and habitat along the park road corridor. The overall level of wildlife resource impacts under Alternative 5 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

VEGETATION AND WETLANDS

The candidate extraction sites are located in areas that have exclusively or predominantly tundra vegetation. At most of the sites the vegetation is a mosaic of upland and wetland tundra cover types, plus some upland forest. The East Fork and Toklat sites generally consist of unvegetated gravel bars, and the Downtown Kantishna site includes extensive areas of unvegetated gravel bars and tailings piles. Vegetative cover at the potential extraction sites has been characterized from interpretation of aerial photographs and on-site investigations.

Wetlands were delineated by technical staff from Hart Crowser, Inc. at 11 prospective gravel acquisition sites in August and September 2001 using the Routine Onsite Determinations methods described in the *Corps of Engineers Wetlands Delineation Manual* (U.S. Army Corps of Engineers 1987). The types, approximate areas, and functions of wetlands delineated at the sites considered in this EA are summarized from the jurisdictional wetland determination report prepared by Hart Crowser (2002). Wetland delineations have not been conducted at the Downtown Kantishna or East Fork River sites. Descriptions of wetlands at the latter two sites are based on a combination of field observations of nearby sites (Kantishna Airstrip, Camp Ridge, and East Fork Cabin), aerial photo

interpretation, and National Wetland Inventory (NWI) maps. Wetland and upland vegetation types described herein follow the *Alaska Vegetation Classification* (Viereck et al. 1992). Wetlands are classified according to the U.S. Fish and Wildlife Service's *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979). Plant nomenclature generally follows Hultén (1968), except where there have been recent taxonomic changes. More recent taxonomy follows Kartesz, as found on the Natural Resources Conservation Service National Plants Database (USDA NRCS 2000) website at http://plants.usda.gov/

Wetland functions at the delineated sites were assessed using *Wetland Values: Concepts and Methods for Wetland Evaluation* (Reppert et al. 1979), also known as the Reppert Method. Using this method a rating of high, moderate or low is given to major functions of wetlands including: natural biological functions, hydrologic support; storm and floodwater storage and retardation (or attenuation); groundwater recharge; and water quality protection or purification. Because of the relatively simple structure, small size, proximity to human activities, and homogeneous nature of site vegetation, functional values range from low to moderate for all sites and functions.

This section of the EA provides a summary of the specific upland vegetation and wetland conditions at each candidate site, followed by a review of the expected impacts for each alternative. Table 4.5 summarizes the wetland determinations, classifications and estimated acres at each site. Table 4.6 presents the summarized results of the functional assessment of the wetlands at the candidate sites. Wetland boundaries at the respective sites are included on the proposed mining plans in Appendix C, and in Appendix D. Existing upland and wetland conditions at each site are summarized, as are expected wetland impacts based on the mapped wetland locations relative to the mining plans. Because upland cover types were not specifically mapped for each site, Table 4.2 and the description of upland conditions at each site represent the expected level of upland impacts.

Teklanika Pit

East of the existing pit area the terrace slopes upward at an estimated 3 to 5 percent grade for a short distance before the gradient steepens to about 15 percent at the foot of the adjacent hills. Relatively poorly defined water tracks exist near the break in topography between the steeper slopes to the east and the gentler 3 to 5 percent slopes of the terrace. These appear to carry shallow surface water flow seasonally to the northwest, where it infiltrates into the ground. General drainage patterns based on topography within this area appear to be to the northwest and west towards the park road and the Teklanika River. There are no apparent surface water connections between these water tracks and the Teklanika River or the apparently perennial stream to the south that is tributary to the Teklanika River. West of the road is a second lower terrace above the Teklanika River.

Uplands

An open white spruce forest community type covers adjacent uplands between the road and the existing gravel pit. This community appears to occupy drier areas adjacent to the road and northwest of the existing pit. Dominant plants in this community include white spruce (*Picea glauca*), willows, dwarf birch, feathermoss (*Hylocomium splendens*), and bog blueberry (*Vaccinium uliginosum*). Other species observed or relatively abundant but not dominant included sedge species, a wintergreen species (*Pyrola* sp.), rough fescue (*Festuca altaica*), and shrubby cinquefoil (*Potentilla fruticosa*). White spruce covers approximately 20 to 30 percent of the area and ranges in size from small seedlings to more mature trees 8 inches in diameter at breast height (dbh). Mature trees are about 25 to 30 feet tall. This upland forest vegetation is found on coarser, drier mineral soils.

TABLE 4.6 SUMMARY OF WETLAND DETERMINATIONS, CLASSIFICATIONS AND ESTIMATED ACRES

Site	Jurisdictional Wetland Determination[1]	Wetland Classification[2]	Estimated Wetland Area on the Site
Teklanika Pit	Non-jurisdictional/isolated	PSS1B	1.2
Toklat River	Jurisdictional	R3US/UB	185
Beaver Pond	Jurisdictional	PSS/EM1B	0
Boundary	Non-jurisdictional/isolated	PSS1C PEM/SS1C	0.4
North Face Corner	Non-jurisdictional/isolated	PSS1/4B	5.7
Moose Creek Terrace	Non-jurisdictional/isolated	PSS1/4B	4.0
Camp Ridge	Non-jurisdictional/isolated	PSS1/4B PEM1B	1.5
Downtown Kantishna	Jurisdictional	PSS1/4B	13.1
	Jurisdictional	R3USCx	1.6
Kantishna Airstrip	Non-jurisdictional/isolated	PSS1/4B	9.1

[1] Preliminary jurisdictional determination. Determinations are subject to verification by the Alaska District, U.S. Army Corps of Engineers.

[2] Wetland classification follows Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979).

Wetlands

Palustrine scrub-scrub broad-leaved deciduous wetlands (PSS1B) associated with lower-lying areas and small water track features cover about 1.2 acres of the site (see Table 4.6). Scrub-shrub vegetation consists of a dwarf scrub community that varies in species composition across the site. Dominant plants include dwarf birch (*Betula nana*), willows (*Salix* sp.) that are generally less than 2 feet tall, sedges (*Carex* sp.), and polar grass (*Arctagrostis latifolia*). Cloudberry (*Rubus chamaemorus*), Arctic sweet coltsfoot (*Petasites frigidus*), cottongrass (*Eriophorum* sp.), sphagnum moss (*Sphagnum* sp.), and leatherleaf (*Chamaedaphne calyculata*) are associated species. Cloudberry, Arctic sweet coltsfoot, sphagnum and are most abundant in and immediately adjacent to the small water tracks that generally run from ESE to NNW from near the SE corner towards the north end of the site. The water tracks terminate south of the north boundary in a variation of the dwarf scrub community characterized by taller dwarf birch and willows, up to about 3 feet tall. Small tussocks are scattered throughout the area. Shallow, organic (peat) soils that support this wetland vegetation are seasonally or permanently saturated. Dwarf deciduous scrub-shrub wetland types are widespread in the park.

Wetland functions at this site were rated as moderate for biological functions and sanctuary/refuge, and low or relatively low for the four water resource functions (see Table 4.7).

TABLE 4.7 SUMMARY OF RESULTS OF MODIFIED REPPERT FUNCTIONAL ASSESSMENT

Wetland	Wetland Classification[1]	Natural Biological Functions	Study Area, Sanctuary, Refuge	Hydrologic Support	Storm & Floodwater Storage & Retardation	Ground water Recharge	Water Purification
TP	PSS1B	Moderate	Moderate	Relatively low	Relatively low	Low	Relatively low
EFR	R3US/UB	Relatively low	Relatively low	Relatively low	Moderate	Moderate	Relatively low
TR	R3US/UB	Relatively low	Relatively low	Relatively low	Moderate	Moderate	Relatively low
BP	PSS/EM1B	Moderately high	Moderate	Moderate	Relatively low	Low	Relatively low
B	PSS/EM1C	Moderately high	Moderate	Relatively low	Relatively low	Moderate	Relatively low
NFC	PSS1/4B	Moderate	Moderate	Moderate	Relatively low	Low	Relatively low
MCT	PSS1/4B	Moderate	Moderate	Moderate	Relatively low	Low	Relatively low
CR	PSS1/4B and PEM1B	Moderate	Moderate	Moderate	Relatively low	Low	Relatively low
DK	PSS1/4B	Moderate	Moderate	Moderate	Moderate	Low	Low
	R3USCx	Low	Low	Low	Moderate	Low	Low
KA	PSS1/4B	Moderate	Moderate	Moderate	Relatively low	Low	Relatively low

[1] Wetland classification follows Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979).

TP –Teklanika Pit; EFR – East Fork River; TR – Toklat River; BP – Beaver Pond; B –Boundary; NFC – North Face Corner; MCT – Moose Creek Terrace; CR – Camp Ridge; DK – Downtown Kantishna; KA – Kantishna Airstrip.

Wetland Impacts

Approximately 1.2 acres of PSS1B wetlands north of the existing operations in units 1 and 2 would be removed under the proposed extraction plans. Operations in unit 3 would not adversely affect any wetlands. These appear to be isolated and non-jurisdictional wetlands that are common throughout the park. Because of their small size and isolated nature, there would be a minor loss of wetland functions. Potential wetland impacts on the site have been avoided through the configuration of the proposed operational units. Wetlands east of the existing pit would be avoided entirely. It is unlikely there would be any indirect affects of proposed gravel mining on other nearby wetlands.

East Fork River

This site is located in the floodplain of the East Fork of the Toklat River. Because the site has a low gradient and the valley bottom is wide, the active channel has a very broad, shallow, and braided configuration. The gradient is estimated to be about 2 to 3%.

Uplands

The steep embankments of the river are covered by tall and dwarf scrub communities commonly found adjacent to braided rivers. Tall scrub communities are dominated by pioneer species, such as alders and willows. Where wetland hydrology and hydric (wetland) soils are present, these communities are considered scrub-shrub wetlands. Dwarf scrub communities are dominated by cranberry and blueberry species (*Vaccinium* spp.), crowberry (*Empetrum nigrum*), and Labrador tea (*Ledum palustre*). Soils often contain appreciable quantities of gravel (alluvium) and appear to be relatively well drained.

Wetlands

The entire site (111 acres) consists of unvegetated gravel bars within the active channel of the East Fork Toklat River (see Table 4.6). It is not clear why a part of these gravel deposits are identified as upland on the National Wetlands Inventory map for this area. Most gravel bars and braided channels are classified as riverine upper perennial unconsolidated shore/unconsolidated bottom (R3US/UB) wetlands. These wetlands are widespread in the park and associated with all of the larger rivers, including the Toklat River, Teklanika River, Sanctuary River, and Savage River.

These riverine upper perennial wetlands appear to provide moderate to low levels of most functions (see Table 4.7). The ratings are moderate for storm and floodwater storage and retardation (or attenuation) and groundwater recharge, given their large size and connectivity with other wetlands and adjacent uplands. The water quality protection or purification function appears to be relatively low because the only source of pollutants is atmospheric deposition.

Wetland Impacts

Approximately 1.3 acres of riverine upper perennial unconsolidated shore/unconsolidated bottom (R3US/UB) wetlands would be affected annually by gravel extraction. In addition, up to approximately 1 acre of wetlands would be affected by the temporary access road. These would likely result in minor temporary impacts to wetland functions. Turbidity is naturally high in the river from glacial flour. Gravel extraction might result in slight increases in turbidities downstream. However, these are not expected to result in measurable changes in primary or secondary productivity. In addition, removal of material would result in only temporary losses of habitat (interstitial spaces and

substrate). Gravels removed in any one year would be replenished as new gravels are annually transported down the river during spring freshets and summer high flows. Temporary impacts to wetland functions would be reduced through construction of mirror channels and natural recruitment of new gravels from upstream through bedload transport processes.

Toklat River

This site is located in the floodplain of the Toklat River. Because the site has a low gradient and the valley bottom is wide, the active channel has a very broad, shallow, and braided configuration. The gradient is reported to be 1.5%.

Uplands

The embankments of the river are covered by tall and dwarf scrub communities commonly found adjacent to braided rivers. Tall scrub communities are dominated by pioneer species, such as alders and willows. Where wetland hydrology and hydric (wetland) soils are present, these communities are considered scrub-shrub wetlands. Dwarf scrub communities are dominated by cranberry and blueberry species (*Vaccinium* spp.), crowberry (*Empetrum nigrum*), and Labrador tea (*Ledum palustre*). Soils often contain appreciable quantities of gravel (alluvium) and appear to be relatively well drained.

Wetlands

The entire site (185 acres) consists of unvegetated gravel bars within the active channel of the Toklat River (see Table 4.6). The gravel bars and braided channels are classified as riverine upper perennial unconsolidated shore/Unconsolidated bottom (R3US/UB) wetlands. These wetlands are widespread in the park and associated with all of the larger rivers, including the Toklat River, Teklanika River, Sanctuary River, and Savage River.

These upper perennial wetlands appear to provide moderate to low levels of most functions (see Table 4.7). The ratings are moderate for storm and floodwater storage and retardation (or attenuation) and groundwater recharge, given their large size and connectivity with other wetlands and adjacent uplands. The water quality protection or purification function appears to be relatively low because the only source of pollutants is atmospheric deposition.

Wetland Impacts

Approximately 2.3 acres of riverine lower perennial unconsolidated shore (R3US/UB) wetlands would be affected by anticipated annual gravel extraction. Up to an additional acre would be affected by a temporary access road. These would likely result in minor temporary impacts to wetland functions similar to those described for the wetlands at the East Fork River site. Like East Fork River, the Toklat River is transport limited. Gravels removed in any one year would be replenished as new gravels are annually transported down the river during spring freshets and summer higher flows. Temporary impacts to wetland functions would be reduced through construction of mirror channels and natural recruitment of new gravels from upstream through bedload transport processes.

Beaver Pond

This site is located on a terrace approximately 40 to 55 feet above the floor of the unnamed perennial stream on the valley bottom. Historic gravel mining operations were conducted near the middle of

this site. On the west side of the old gravel operations, the top of the terrace has very gentle slopes ranging from about 2 to 4 percent. The general drainage pattern appears to be to the SSW and WSW toward the unnamed stream. Slopes on the eastern portion of the site are slightly steeper (4 to 15 percent) and include a small apparently perennial and more or less beaded stream that is tributary to the larger stream downslope. Drainage on this side of the site is directly to the beaded stream. The side slopes on the south side of the terrace are steep, about 30 to 40 percent.

Uplands

Dwarf-low scrub, tall scrub, and graminoid-forb herbaceous communities occur on the portion of the site west of the old works. Soils on the hummocky topography supporting this vegetation were much coarser and were more well drained than those observed in the wetlands.

Wetlands

There is a mosaic of palustrine scrub-shrub broad-leaved deciduous and emergent wetlands (PSS/EM1B) that cover an area of approximately 0.4 acre east of the proposed mine site. Wetlands are composed of a mixture of dwarf scrub, tall scrub and mixed graminoid-forb herbaceous vegetation associated with a drainage and beaded stream downslope of the Denali Park Road. Dominant plants include willows, dwarf birch, bog blueberry (*Vaccinium uliginosum*), lowbush cranberry (*Vaccinium vitis-idaea*), sedges, and crowberry. Common but not dominant associates included rough fescue, Arctic sweet coltsfoot, mosses, shrubby cinquefoil, and a horsetail species (*Equisetum* sp.). Flow from a network of drainage channels and wetlands north of the park road appears to be concentrated and conveyed to this wetland through the culvert in the road. Surface water enters the wetland and spreads out in the tall scrub community at the south edge of the park road. Downslope surface water flow becomes more concentrated in a drainage channel and beaded stream that flows into the larger perennial stream on the valley floor to the south. Permanently saturated mineral soils around shallowly inundated areas and beads (ponds) of the stream are covered by the mixed graminoid-forb vegetation and scrub vegetation is in between the nodes of the stream and higher gradient areas. These palustrine scrub-shrub and emergent wetland types are common throughout the park.

Natural biological functions, including food chain production and general and specialized habitat are moderately high because of surface water connections to aquatic environments (the beaded stream) as well as the larger size of these wetlands. Hydrologic support functions are higher because of the presence of the beaded stream. Groundwater recharge appears low because the wetland is such a small proportion of the total subbasin area. Although vegetation density is high, water purification or protection appears to be only moderate because the only source of pollutants to this area, other than road dust, is from atmospheric deposition.

Wetland Impacts

Impacts to PSS/EM1B wetlands at this site would be avoided as a result of the configuration of the mining plan. It is expected there would be no direct impacts to wetlands and negligible indirect effects. In addition, proposed reclamation might result in the creation of new wetlands.

Boundary

Topography at the Boundary site consists of a series of small hills and depressions near the base of the mountain to the northeast. Evidence of historic gravel mining operations exists on the site. Slopes are variable, ranging from flat in the closed depressions to between 25 and 30 percent on the hillocks

surrounding them. The general drainage pattern appears to be to the SSW from the mountain to the NE and towards the closed depressions from the surrounding hillocks.

Uplands

A more xeric (dry) dwarf-low scrub community is common on adjacent uplands on the tops and sides of the hillocks. Dominant plants in this community type are bog blueberry, lowbush cranberry, dwarf birch, Labrador tea, and crowberry. Other plants that are present but not dominant in this community include willows, white spruce, rough fescue, an alder (*Alnus* sp.), lichens, and mosses. Coarse mineral soils that support this community appear to be well drained. In addition to the dwarf-low scrub type, there was a mixed graminoid-forb herbaceous community located in another closed depression at this site. Dominant plants included sedges, rough fescue, violet, nagoon-berry (*Rubus arcticus*), bog blueberry, and willow. Dwarf shrubs covered about 20 percent of the entire area. Although this community was located in a depression, loamy mineral soils contained many large cobbles and appeared to be well drained.

Wetlands

Wetlands cover an area of about 0.4 acre and consist of an isolated, seasonally saturated, palustrine broad-leaved deciduous scrub-shrub and emergent system (PSS/EM1C) located in a closed depression. The dwarf-low shrub vegetation is dominated by dwarf willows, bog blueberry, lowbush cranberry, dwarf birch, crowberry, mosses and lichens. Crowberry is abundant and forms dense, continuous patches on the tops and sides of small hummocks. A sedge species is also present but not dominant. The emergent vegetation class is a mixed graminoid and forb community type. Dominant plants included sedges, violet (*Viola* sp.), rough fescue, an oxytrope species (*Oxytropis sp.*), bog blueberry, dwarf birch, moss, and scattered lichens. Mineral soils with an appreciable amount of fines are likely seasonally saturated

Natural biological support functions, storm and floodwater storage, and water purification or protection are rated moderate given the relatively simple vegetation structure, relatively small size, and isolated nature of the wetland. Hydrologic support and groundwater recharge appears low because of the wetlands small size and moderately poorly drained soils.

Wetland Impacts

Proposed mining (under Alternative 2 only) would remove approximately 0.4 acre of PSS/EM1C wetlands. These appear to be isolated and non-jurisdictional wetlands that are common throughout the park. Because of their small size, isolated nature, and historical impacts from past mining, there would be a minor loss of wetland functions.

North Face Corner

The North Face Corner site is on a terrace above the south side of the park road. The existing and active gravel pit exists on the north edge of this terrace, which is about 80 feet above Moose Creek and 30 feet above the road. Topography consists of relatively flat slopes of 2 to 3 percent that appear to drain W and NW towards Moose Creek.

Uplands

Uplands include dwarf-low scrub and open white spruce forest vegetation types found on the adjacent terrace slopes. Species composition of the dwarf and low scrub communities is similar to those described for other sites. The open white spruce forest vegetation contains small white spruce (*Picea glauca*) and dwarf or small shrubs common in the wetlands types. These steep alluvial slopes are characterized by apparently relatively well-drained, coarse mineral soils.

Wetlands

The entire top of the terrace on the site (about 5.7 acres) is an isolated, saturated palustrine scrub-shrub broad-leaved deciduous and broad-leaved evergreen (PSS1/4B) wetland. Dwarf scrub vegetation is dominated by dwarf birch and several ericaceous shrubs, including bog blueberry, Labrador tea, lowbush cranberry, and crowberry. A sedge species, cloudberry, polar grass, and Arctic sweet coltsfoot were among the associated species. Silt loam mineral soils appear to be permanently saturated because of combination of shallow permafrost and subsurface drainage from the mountain slopes to the southwest.

Apparent wetland functions are similar to those provided by other previously described scrub-shrub wetlands. Natural biological support functions, hydrologic support, storm and floodwater storage, groundwater recharge and water quality protection range from low to moderate because of the wetlands landscape position, isolated nature, and relatively simple vegetation structure.

Wetland Impacts

Expansion of the existing mining operations at this site would remove approximately 3.1 acres of PSS1/4B wetlands. Existing operations and relatively high levels of human activity have already reduced the natural biological support functions of these wetlands to some degree. These wetlands are extensive throughout the park and loss of functions from their removal is expected to be moderate. Proposed reclamation might result in the creation of new wetlands assuming the permafrost and hydrology can be restored. Mining might result in changes in the hydrology of wetlands adjacent to Moose Creek that are downslope and to the west of mining area. Removal of the insulating layer is likely to increase the depth of thaw and translate to increased subsurface flows and increased groundwater discharge near the toe of the slope. Changes in hydrology might result in increased nutrient export and mineralization rates and increased forage potential for moose and beavers as willows grow in response to increased nutrient availability.

Moose Creek Terrace

Moose Creek Terrace consists of three different potential operations areas on different old alluvial terraces. The series of alluvial terraces range from about 40 to more than 80 feet above Moose Creek. The steep north-facing slopes of the mountain to the south and relatively flat 1 to 2 percent slopes of the terraces (not including the steep side slopes) appear to drain north toward Moose Creek.

Uplands

Upland vegetation adjacent to wetlands includes dwarf scrub types similar to those described above and an open needleleaf forest type. The latter appears to be an early seral phase of a white spruce forest type. White spruce forms an open canopy (~20 percent cover). In addition to white spruce, the dominant species include willow, dwarf birch, bog blueberry, crowberry, and lowbush crowberry.

Other plants that are present but not dominant included Labrador tea, mosses, and lichens. Upland plant communities were growing in coarser alluvial soils that appeared to be relatively well drained.

Wetlands

There are two wetlands at the Moose Creek Terrace site. These cover a total area of about 4.0 acres. Both are a mixture of palustrine scrub-shrub broad-leaved evergreen and broad-leaved deciduous (PSS1/4B) wetlands characterized by dwarf scrub vegetation types dominated by species similar to those described on other sites. Soils are apparently permanently saturated mineral soils. Shallow subsurface drainage from the slopes to the south appears to be the primary source of wetland hydrology to both wetlands. Because there is no direct surface water connection to Moose Creek, it appears that these are isolated and non-jurisdictional wetlands.

Functions for the PSS1/4B wetlands are similar to those previously discussed. Natural biological support functions may be somewhat higher than most other wetlands given the moderate structural complexity and proximity to the Moose Creek riparian corridor that provide habitat and travel corridor opportunities to fish and wildlife. Hydrologic support, storm and floodwater storage, groundwater recharge, and water purification or protection range from low to moderate.

Wetland Impacts

An estimated 4.0 acres of PSS1/4B wetlands would be temporarily altered by proposed mining. These wetlands appear to be isolated and non-jurisdictional wetlands. Proposed topsoil/overburden areas 1-3 are located in wetlands, as are the proposed stockpile/reject area and crusher/screenplant. Temporary alterations could be reduced by minimizing the footprint of topsoil and overburden stockpiles, stockpile/reject, and crusher/screenplant areas. There would be a temporary loss of some wetland functions during mining, such as some of the biological support functions as habitat would be unusable. Because of their temporary nature, these impacts are expected to be negligible. Assuming that wetlands would be restored upon removal of the topsoil and overburden, wetland functions would be restored as the wetlands recovered from this disturbance.

Camp Ridge

The Camp Ridge terrace is more than 100 feet above Moose Creek on the north side of the park road. Site drainage is WNW and W towards Moose Creek. Much of the site is characterized by gentle, 2 to 4 percent slopes. A small segment of the site, which is west of a small drainage, contains steeper forested slopes.

Uplands

An apparently older seral-phase needleleaf forest community type covers the steeper slopes (25 to 30 percent) on the western side of the small drainage. This community contained denser stands of white spruce (about 40 to 45 percent cover) that were considerably larger than elsewhere on the site. Dominant plants in this species-rich community included many of the same species observed elsewhere on the site, and also netleaf willow and rough fescue. Other plants present but not dominant included lichens and shrubby cinquefoil. Coarser-textured, better drained soils support this forest type.

Wetlands

Much of the site is wetland (1.5 acres) consisting of a mosaic of PSS1/4B and PEM1B wetlands. Wetlands consist of an open needleleaf forest type, dwarf scrub, and tussock tundra community types. Tree cover is generally less than 30 percent in the open needleleaf forest, so it is not considered a forested wetland according to the USFWS wetland classification system (Cowardin et. al. 1979). In addition, a portion of the site is characterized by a tussock tundra vegetation type that is classified as PEM1B wetland. White spruce and ericaceous shrubs similar to previously described scrub-shrub wetlands are dominant. Tussock tundra vegetation includes dwarf ericaceous shrub species similar to other wetlands as well as scattered black spruce (*Picea mariana*) and tussocks formed by cottongrass and sedges. Soils appear to be permanently saturated as a result of shallow permafrost and subsurface drainage patterns and range from mineral to organic (sphagnum peat). These palustrine scrub shrub and emergent wetlands appear to provide low to moderate levels of all functions, similar to previously described isolated wetlands.

Wetland Impacts

Approximately 1.5 acres of an apparently isolated, non-jurisdictional wetland complex composed of PSS1/4B and PEM1B classes would be removed by gravel mining. Although these types of wetlands are common in the park, this was the lone example of tundra and open forested/scrub-shrub wetland observed at the proposed gravel extraction sites being considered. Assuming this is representative of the overall distribution of this wetland type, it is less common than the other types encountered. Loss of these wetlands would likely not result in a major loss of functions. However, organic (peat) soils and the tundra (PEM1B) wetland vegetation class takes the most time to develop of all of the wetland types observed at the investigated sites, and cannot be easily restored or replaced. Potential impacts could be reduced by minimizing the mining footprint and replacing topsoil/overburden following completion of gravel mining.

Downtown Kantishna

This site is relatively flat and located in the floodplain of Moose Creek. Elevations on the site range from about 5 to 10 feet above the ordinary high water mark of Moose Creek. Much of the site has been disturbed by historic placer mining and contains tailings piles, abandoned channels, trails, and settling ponds. There are a couple of small tributary channels to Moose Creek near the northeast end of the site.

Uplands

Much of the site is unvegetated mine tailings. There is relatively sparse vegetation that includes some regrowth of alder, cottonwood, and willow.

Wetlands

The NWI map shows relatively extensive PSS1/4B wetland along the southwest boundary of the site. In addition to the palustrine wetlands, there are three riverine wetlands, Moose Creek (R3UBH) Eldorado Creek (R3UBHx) and a seasonally flooded, excavated unsolidated shore (R3USCx) wetland in the northeast corner. Palustrine scrub-shrub wetlands appear to be associated with a lower lying area and small tributary drainages or side channels of Moose Creek. Dominant plants in this wetland include willows and dwarf evergreen shrubs similar to those for other wetlands with this classification. Soils are likely relatively shallow and permanently saturated. Both riverine wetlands have been disturbed by historic placer mining activities. These wetlands are generally unvegetated braided channels or sparsely vegetated gravel bars. Where vegetation exists, it consists primarily of pioneer species, including willows, alder and cottonwood.

Because of the disturbed nature of much of the site, wetland functions are relatively low for all categories except flood storage and attenuation for the R3USCx wetlands. Because the site is in the floodplain, this function appears to be moderate. PSS1/4B wetlands appear to provide higher functions, as shown in Table 4.4, because of their size and less disturbed nature.

Wetland Impacts

An estimated 13.1 acres of PSS1/4B wetlands could be affected by gravel extraction along the southwest boundary of the proposed site, unless the mining and reclamation activity were limited to the previously disturbed areas of the site. In addition, 1.6 acre of R3USCx wetland, which is likely a feature of historic placer mining, would be affected by gravel extraction. These wetlands appear to be associated with a small tributary drainage or side channel of Moose Creek and likely would be considered jurisdictional wetlands. It is assumed that impacts to riverine wetlands would be avoided or minimal, considering the proposed reclamation plans for the site. Impacts to palustrine wetlands at the north end of the site could likely be avoided or reduced by concentrating extraction and related operations over the rest of the site.

Kantishna Airstrip

The Kantishna Airstrip terrace is about 10 to 15 feet above the beaver pond wetland complex to the northwest and more than 30 feet above Moose Creek. There are two tiers to the terrace, a higher elevation tier to the south and a lower tier to the north. Water tracks that appear to carry seasonal flow to the beaver ponds occur at the base of the steep forested southwest slopes of Wickersham Dome that abut the site to the north. Site drainage, based on surface topography, appears to be NNW and WNW towards the beaver ponds and Moose Creek. Slopes on the top of the terrace are 1 to 2 percent. Side slopes are steeper (~15 to 20 percent). The southwest slopes of Wickersham Dome are very steep (~30 to 40 percent).

Uplands

Adjacent uplands are similar to those at other sites. Dwarf scrub communities are found on the side slopes of the terrace. Soils on the slopes appear to be relatively well drained.

Wetlands

The entire top of the terrace (about 9.1 acres) at this site is a mixed PSS1/4B wetland. The dwarf scrub vegetation is dominated by plants similar to those at wetlands described previously. Other plants that were common but not dominant included woodland horsetail (*Equisetum sylvaticum*), black spruce, sedges, and lichens.

This wetland appears to provide similar functions as the other PSS1/4B wetlands. Functions range from low to moderate.

Wetland Impacts

About 9.1 acres of apparently isolated, non-jurisdictional PSS1/4B wetlands could be removed by gravel mining, depending on the extent of activity at this location. This wetland type is common throughout the park and this impact would be unlikely to result in a major loss of wetland functions. Removal of wetlands could alter hydrology and water quality in wetlands to the northwest and west that are between the road and the toe of slope of the terrace where this site is located. Potential

impacts could be reduced by reducing the size of the proposed operation and through implementation of the proposed reclamation.

Proposed Mitigation

The proposed action includes a variety of measures in all alternatives to mitigate and monitor impacts of the actions on wetlands and other environmental resources. Measures used to mitigate impacts include avoidance, minimization through modification of proposed mining plans and, lastly, compensation for unavoidable impacts. The process to be followed for development and operation of upland and floodplain extraction and processing sites (described in detail in Chapter 2 of the EA) include specific prescriptions for identifying the area to be included in the active operations and installing erosion and sedimentation control measures. Sites would be designed so that restoration of the extraction area could occur quickly and return natural functions and processes to the sites. Operational monitoring, sediment monitoring and project documentation common to all sites and alternatives would include monitoring and records pertinent to wetland conditions before and after extraction activities. Restoration of the gravel source sites operated through this plan will, in general, not be considered to provide the compensation necessary for new wetland impacts.

The Downtown Kantishna site represents an exception to this condition. Wetland and floodplain resources at the Downtown Kantishna site have been considerably disturbed by past placer mining activity at the site, and the NPS has identified this site as a high priority for reclamation. While this site would be used for gravel extraction, the gravel removal would occur as an integral and necessary component of site reclamation. Because of the current degraded status of the Downtown Kantishna site, the serious need for reclamation of a functional stream/wetland/riparian system, and the need to recontour the floodplain to accomplish the reclamation, the Downtown Kantishna site would serve both purposes of gravel supply and compensation for wetland impacts.

Compensation, by restoration of previously degraded wetlands, is required under the NPS no-net-loss policy for projects involving disturbance or loss of wetlands. Gravel extraction and processing operations are not exempt from this requirement. Compensation will occur for the unavoidable loss or disturbance of wetland area at gravel source sites over the next 10 years. Compensation requirements and corresponding restoration plans have not yet been developed, pending NPS selection of a GAP alternative to be implemented, confirmed determination of the jurisdictional character of the affected wetlands, and final determination of the affected wetland acres and functions. However, the NPS has identified two sites as priority candidate locations for restoration of previously disturbed wetland areas. The sites are the Little Audrey and Yellow Pup mining claims, located in the Glacier Creek drainage northeast of Kantishna (see Maps D.1 and D.2). Wetland and riparian areas at both sites were disturbed by historic placer mining activities. The NPS estimates that the restoration areas for these sites could be approximately 10 acres at the former Little Audrey claims on Glacier Creek and 7.5 acres at the former placer claims on Yellow Pup Creek, a tributary to Glacier Creek. Restoration work would begin at these sites in 2004, and would follow an approach similar to NPS restoration of comparable disturbed areas along Caribou Creek in 2002.

Impacts by Alternative

The maximum total estimated wetland impact for each site and alternative is described in this section. Table 4.7 provides a summary of potentially affected wetland acreage by site, wetland type and alternative; these figures are based on the estimated wetland acreage within the mining plan envelope for each site, as displayed in Appendix C. To put the potential impacts in some sort of context, they are discussed by the type of wetlands affected, their apparent functions, and the potential ability for

the affected wetlands to be restored or recreated by proposed reclamation. Appendix D contains a summary of wetland evaluations and findings.

TABLE 4.8 SUMMARY OF POTENTIAL WETLAND IMPACTS BY ALTERNATIVE (ACRES)

Site	Wetland Classification[1]	Alternative1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
TP	PSS1B[2]	0.8	1.2	1.2	1.2	1.2
EFR	R3US/UB		2.3[3]		2.3[3]	2.3[3]
TR	R3US/UB	2.2	3.3[3]	3.3[3]	3.3[3]	3.3[3]
BP	PSS/EM1B					
B	PSS/EM1C[2]		0.4			
NFC	PSS1/4B[2]					3.1
MCT	PSS1/4B[2]			4.0	4.0	
CR	PSS1/4B[2] and		0.7			
	PEM1B[2]		0.8			
DK[4]	PSS1/4B					
	R3USCx		1.6		1.6	1.6
KA	PSS1/4B[2]		9.1			
	Total Impact (acres)	3.0	19.4	8.5	12.4	11.5

[1] Wetland classification follows Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979)

[2] Appear to be isolated, non-jurisdictional wetlands. The Alaska District, U.S. Army Corps of Engineers will make the final jurisdictional determination.

[3] Including up to an acre of impacts from the temporary (seasonal) access road.

[4] It is assumed that potential impacts to riverine wetlands (Moose Creek and Eldorado Creek) would be avoided or negligible. Gravel removal, processing and storage would be limited to previously disturbed areas.

TP – Teklanika Pit; EFR – East Fork River; TR – Toklat River; BP – Beaver Pond; B –Boundary; NFC – North Face Corner; MCT – Moose Creek Terrace; CR – Camp Ridge; DK – Downtown Kantishna; KA – Kantishna Airstrip.

Alternative 1: No Action

The no-action alternative would impact about 3 acres of wetlands, the lowest impact of any alternative. Only those wetlands at the Teklanika Pit (PSS1B), Toklat River (R3US/UB), and North Face Corner (PSS1/4B) would potentially be affected. The river bottom wetlands along the Toklat River are periodically disturbed gravely floodplain areas. There would be very little new impacts from continuing these existing gravel extraction operations.

Cumulative Impacts: Ongoing impacts to wetlands are from park projects to construct new visitor and administrative facilities and from pollution from vehicular use on the park road. Past impacts to wetlands are from construction of the park road and other infrastructure, and from placer mining in the Kantishna Hills. Future impacts to wetlands are expected to be limited to a few acres, at most, from trail construction. Restoration projects on wetlands and floodplains adjacent to placer-mined creeks in the Kantishna Hills would be expected to continue on tens of acres of regulatory wetland. The major increase in vehicle mileage on the park road from gravel hauling activity from this alternative would cause an incremental increase in the volume of dust and other airborne pollutants that would not result in noticeable change to wetland functioning along the road corridor. Destruction of about 1 acre of wetlands at Teklanika Pit under this alternative would have a very small impact on wetland resources along the road corridor. The cumulative impacts to wetlands in the park has been moderate, with a minor impact due to visitor facility construction and a moderate impact from 80 years of placer-mining in the Kantishna Hills.

Conclusion: Alternative 1 would result in negligible new direct and indirect impacts to wetlands. The overall level of wetland impacts under Alternative 1 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 2: Maximum Flexibility/Short Hauls

This alternative would affect the largest amount of wetland area (up to 19.4 acres), the most types of wetlands, and the least common wetland type observed at all of the sites (palustrine emergent wetlands at Boundary and Camp Ridge). Both jurisdictional and non-jurisdictional wetlands would be affected by this alternative, including 7.2 acres of jurisdictional riverine wetlands, 9.8 acres of isolated PSS1/4B wetlands, 0.4 acres of isolated PSS/EM1C wetlands, 1.2 acres of isolated PSS1B wetlands and 0.8 acres of isolated PEM1Bwetlands (Table 4.7). Because loss of wetland functions would be proportional to loss of wetland area, this alternative also would contribute to a greater loss of functions compared to other alternatives and require the most compensatory mitigation. Even if tundra type (PEM1B) plants, topsoil and overburden are stockpiled, wetlands with peat (organic) soils are unlikely to be successfully restored or recreated. Organic soils, tussocks, and processes in these systems are not replicable at this time. There might be some risk of subsidence and thermokarst from thawing of permafrost, also reducing the potential to restore or recreate wetlands at the North Face Corner and Camp Ridge sites. This alternative would have the greatest losses of wetland acres and functions of all the action alternatives. Overall wetland impacts would be moderate, and would be greater than the other action alternatives.

Cumulative Impacts: Other considerations for cumulative impacts to wetlands would be similar as described for Alternative 1. The cumulative impacts to wetlands in the park has been moderate, with a minor impact due to visitor facility construction and a moderate impact from 80 years of placer-mining in the Kantishna Hills. This alternative would add up to 19 acres of direct impacts to wetlands, but these effects would be mitigated in part with compensatory wetland restoration at previously disturbed sites in the Glacier Creek drainage and Downtown Kantishna site. The overall cumulative impacts to wetlands would remain moderate.

Conclusion: Alternative 2 would result in moderate overall direct and indirect impacts to wetlands habitat along the park road corridor. The overall level of wetland impacts under Alternative 2 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 3: Minimum Visual Intrusion/Long Hauls

Fewer potential wetland impacts would occur from this alternative, compared to Alternatives 2, 4, or 5, an estimated maximum of 8.5 acres. Only those wetlands most commonly found along the park road corridor and at potential extraction sites would be affected and most of these would be jurisdictional riverine wetlands (3.3 acres) that would result in temporary impacts on wetland functions. In addition, approximately 1.2 acres of isolated and non-jurisdictional PSS1B wetlands and 1.4 acres of isolated and non-jurisdictional PSS1/4B wetlands would be affected. Potential losses of wetland acres and functions would be the lowest among the action alternatives, but greater than for Alternative 1. Overall wetland impacts would be minor.

Cumulative Impacts: Other considerations for cumulative impacts to wetlands would be similar as described for Alternatives 1 and 2. The cumulative impacts to wetlands in the park has been

moderate, with a minor impact due to visitor facility construction and a moderate impact from 80 years of placer-mining in the Kantishna Hills. Proposed placer mining restoration at Glacier Creek would reduce the overall adverse impacts to wetlands in the park. This alternative would result in up to 8. 5 acres of impacts to wetlands (the least of all the action alternatives), but the overall cumulative impacts to wetlands would remain moderate.

Conclusion: Alternative 3 would result in minor overall direct and indirect impacts to wetlands habitat along the park road corridor. The overall level of wetland impacts under Alternative 3 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 4: Phased Development of Moderate Number of Sites *(NPS Preferred)*

This alternative would affect a combined total of up to 12.4 acres of jurisdictional and non-jurisdictional wetlands. Alternative 4 would affect the same amount of jurisdictional wetlands (5.6 acres of R3US/UB)as Alternative 2 or Alternative 5. Approximately 1.2 acres of isolated and non-jurisdictional PSS1B and 4.0 acres of isolated and non-jurisdictional PSS1/4B wetlands also would be affected. This alternative would have greater potential impacts on wetland acres and functions than Alternative 3, but lower potential impacts of both wetland acreage and functions compared to Alternative 2. All of the wetlands impacted by this alternative are common throughout the park and the surrounding region. Overall wetland impacts would be less than with Alternative 2, but potential impacts are higher than Alternative 3 and slightly higher than Alternative 5. Direct impacts to wetlands at the Moose Creek Terrace site could be reduced by moving processing and stockpiling activities onto newly excavated upland areas as the site is developed. Direct and indirect wetlands impacts would be long-term in a few small isolated locations, or moderate.

Cumulative Impacts: Considerations for cumulative impacts to wetlands would be similar as described for Alternatives 1 and 2. The cumulative impacts to wetlands in the park has been moderate, with a minor impact due to visitor facility construction and a moderate impact from 80 years of placer-mining in the Kantishna Hills. Proposed placer mining restoration at Glacier Creek and Downtown Kantishna would reduce the overall adverse impacts to wetlands in the park. This alternative would result in up to 12.4 acres of additional impacts to wetlands, but the overall cumulative impacts to wetlands would remain moderate.

Conclusion: Alternative 4 would result in moderate overall direct and indirect impacts to wetlands habitat along the park road corridor. The overall level of wetland impacts under Alternative 4 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

The total affected wetland area for this alternative is estimated at a maximum of 11.5 acres. Alternative 5 would result in similar impacts to jurisdictional riverine and jurisdictional PSS1/4B wetlands compared to Alternative 2 and Alternative 4, and slightly lower impacts on jurisdictional riverine wetlands compared to Alternative 3. Compared to Alternative 4, total impacts to isolated and non-jurisdictional PSS1/4B wetlands for this alternative would be approximately0.9 acres less. Alternative 5 would involve the same amount of impacts (about 1.2 acres) to isolated and non-jurisdictional PSS1B wetlands as all other action alternatives. Potential for wetland losses and associated functions for Alternative 5 are higher than for Alternative 3, but lower than for Alternative

2 and Alternative 4 (by a small margin). As with alternative 4, the overall direct and indirect impacts to wetlands would be moderate.

Cumulative Impacts: Considerations for cumulative impacts to wetlands would be similar as described for Alternatives 1, 2, and 4. The cumulative impacts to wetlands in the park have been moderate, with a minor impact due to visitor facility construction and a moderate impact from 80 years of placer mining in the Kantishna Hills. Proposed placer mining restoration at Glacier Creek and Downtown Kantishna would reduce the overall adverse impacts to wetlands in the park. This alternative would result in up to 11.5 acres of additional impacts to wetlands, and the overall cumulative impacts to wetlands would remain moderate.

Conclusion: Alternative 5 would result in moderate direct and indirect impacts to wetlands habitat along the park road corridor. The overall level of wetland impacts under Alternative 5 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

FLOODPLAINS

The current Gravel Acquisition Plan considers five alternatives to acquire sufficient gravel over a 10-year period to maintain and repair the park road. Within the alternatives there are 10 total sites considered as potential gravel sources, 3 of which lie within a floodplain. East Fork River and Downtown Kantishna are new potential sites and Toklat River is currently operating.

Executive Order 11988 (Floodplain Management) requires the NPS, and other federal agencies, to evaluate the impacts its actions are likely to have on floodplains. This executive order requires that short and long-term adverse impacts associated with occupancy, modification or destruction of floodplains be avoided whenever possible. Indirect support of development and new construction in such areas should be avoided wherever there is a practicable alternative. To comply with these orders, the NPS has developed a set of agency policies and procedures, which can be found in Special Directive: 93-4: Floodplain Management Guideline. Compliance with Executive Order 11988 and Special Directive 93-4 is addressed in a Statement of Findings (SOF) presented as Appendix E to this EA.

Methods to minimize damage from a 100-year flood, as described in the National Flood Insurance Program (NFIP) “Floodplain Management Criteria for Flood Prone Areas” (44 CFR 60.3), do not apply to this project.

No significant risk to human health or safety would occur as a result of this project. The gravel extraction and processing work would take place during periods of low visitation. No downstream activities or development would be affected.

Summary of Site-Specific Impacts

All five of the alternatives evaluated in the EA would result in temporary physical disturbances to floodplains in Denali National Park. Table 2.1 indicates which of the floodplain sites would be included in which GAP alternatives. Alternative 1 and Alternative 3 would continue to extract and processes borrow material from the Toklat River site, but would not involve use of other floodplain sites. Alternative 2 would utilize material from the Toklat River, the East Fork River, and the Downtown Kantishna sites. Alternatives 4 and 5 both use material extracted from the Toklat River, East Fork River, and Downtown Kantishna sites.

Toklat River

The Toklat River site is positioned in the floodplain of the Toklat River about 0.75 miles north of Mile 53.4 of the park road. A 14- to 20-foot-wide, 0.75-mile-long gravel spur road from the park road to the Toklat Camp provides access to the edge of the floodplain and processing area. To acquire additional gravel from this site, heavy equipment would drive out onto the floodplain from a ramp at the end of the Toklat Camp access road. Extraction and processing activities would occur mostly before or after the bulk of the summer visitation season, because this site is visible from the park road. Studies of Toklat River bed-load transport (Karle 1989 and Emmet 2000) indicate that an annual average of 11,100 cy per year could be safely removed from the floodplain without adversely affecting river processes. The NPS (1999) previously concluded that the operation proposed for the Toklat River site could be conducted without significant effects to the floodplain.

East Fork River

This site is positioned in the floodplain of the East Fork of the Toklat River south of Mile 43.6 of the park road. A 10- to 12-foot-wide, 0.25-mile-long gravel spur road from the park road to the East Fork Cabin provides access to the edge of the flood plain. As with the Toklat River site, heavy equipment would drive out onto the floodplain from a ramp at the end of the East Fork Road to access the floodplain gravel source. Studies of East Fork River bed-load transport (Emmet 2002) indicate up to 5,400 cy/yr could safely be removed from the floodplain without adversely affecting river processes. Similar to the Toklat River situation, gravel could be extracted from the East Fork River site without significant impacts to the floodplain.

Extraction activities at the East Fork River would occur during September or in emergency situations. Extraction and processing would occur mostly before or after the bulk of the summer visitation season, because this site is highly visible from the park road. The East Fork River would be utilized under Alternatives 2, 4, and 5. In all three cases, the site would be reserved for emergency road repairs on the park road between the Teklanika Pit (Mile 27) and the Toklat River site (Mile 53).

Downtown Kantishna

This large area lies on the western side of Moose Creek, immediately north of the Kantishna Roadhouse, and across Moose Creek beginning at Mile 91 of the park road. Access to the site is currently available by a gravel road with a ford at Moose Creek, but a bridge would be needed in the future to facilitate access by heavy equipment. The site dimensions are about 3,700 feet long by about 1,000 feet wide, with an estimated deposit thickness of 5 to 10 feet. The site covers about 55 acres. The site is estimated to produce a maximum yield of 59,000 cy of material. Though most of the area was previously disturbed, much of the area has already been colonized with alders, willows, cottonwood, and white spruce trees. Very little overburden occurs on the site.

This site would be operated throughout the summer season as needed. The process and storage area would be in the middle of the extraction area, to minimize visibility of the operations from the park road, Kantishna Roadhouse and Denali Backcountry Lodge. Operations at this site would necessarily involve equipment activity within and between the stream channels existing at this site, and there would be physical disturbance of the floodplain over a rather extensive area. The residual level of impact to the floodplains of Moose Creek and Eldorado Creek would depend largely upon the success of the reclamation plans for the site. Successful restoration would be able to reverse floodplain impacts from historic mining activities, including the loss of a substantial length of the original Eldorado Creek channel. Following restoration, NPS management of the site would be to protect the natural values and functions of the site.

Mitigation Measures

At both the East Fork and Toklat River sites, mirror channels would be excavated with a front-end loader from a downstream position to an upstream position beside an active river channel. Gravel from these mirror-channel cuts would be immediately loaded into dump trucks. Each mirror channel would be reclaimed within 5 years by natural stream flow processes, as the river dropped bed load to fill the cuts. Because no vegetation survives in the active floodplain, vegetative recovery would not be needed. The NPS would make annual level surveys across, above, and below the extraction area to assure natural river processes were not adversely affected.

Restoration plans for the Downtown Kantishna site have to date not been developed beyond the conceptual level. In general, those plans indicate that following removal of the planned gravel volume, the surface of the site would be contoured to match surrounding grades and to produce adequate meandering channels in Eldorado and Moose Creeks to facilitate fish passage. The final site contours would also provide for natural floodplain development on the site, rather than defining narrow channels for the creeks. The NPS may employ similar re-vegetation techniques to this area as were used to restore mining claims on Glen Creek.

General Impact Conclusion

With implementation of mitigation measures and successful reclamation of the sites, there would be minimal adverse impacts on floodplain values associated with any of the alternatives considered for this project. Use of the Toklat site is common to all five alternatives evaluated in the EA. Previous NPS EAs prepared in 1992 and 1999 (the latter specifically for the Toklat Borrow Material Processing Site) found that operations taking place in the Toklat River floodplain would not have significant effects on floodplain values. Impacts on the East Fork River from gravel mining would be essentially the same as those at the Toklat River site; removing material at the proposed rates would allow either site to be reclaimed within 5 years by natural stream processes.

Gravel acquisition is proposed for the Downtown Kantishna site under Alternatives 2, 4, and 5. In each the NPS objective is to mine material and reclaim the site during the life of the plan. Because this area has been substantially disturbed by mining activities in the past 50 years, reclamation of the site is a necessary activity in any event. All three alternatives that include Downtown Kantishna incorporate reclamation at the site after gravel extraction operations have been completed. Assuming the reclamation plan would be successful, the natural function of the floodplain would be restored and long-term effects on the floodplain would be minimal.

Based on these expected outcomes, none of the alternatives under consideration would be likely to have more than a minor adverse effect upon the integrity of floodplain resources in the park. With reclamation of the Downtown Kantishna site, natural floodplain functions that had been modified by cumulative mining impacts would actually be improved relative to the current condition.

Impacts by Alternative

Alternative 1: No Action

Alternative 1 would continue to remove the same amount of gravel from the floodplain at the Toklat River site, which would be reclaimed by natural processes within 5 years. This would result in little or no change from past practices.

Cumulative Impacts: Ongoing impacts to floodplains are from gravel extraction at Toklat River. Past impacts to floodplains are from construction of the park road, walling-off 4.77 acres of the Toklat floodplain as a gravel-processing site, and from 80 years of placer mining in the Kantishna Hills. Future impacts to floodplains are not expected at this time. Restoration projects on floodplains adjacent to placer-mined creeks in the Kantishna Hills are expected to continue on tens of acres of floodplains. Continued excavation at Toklat River would have a negligible effect on floodplain functioning. The cumulative impacts to floodplains in the park have been moderate, with a minor impact due to administrative facility construction and a moderate impact from 80 years of placer mining in the Kantishna Hills.

Conclusion: Alternative 1 would result in negligible direct and indirect impacts to floodplains. The overall level of floodplain impacts under Alternative 1 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 2: Maximum Flexibility/Short Hauls

Alternative 2 would extract gravel from two new sites (East Fork River and Downtown Kantishna), and would extract gravel at a greater rate from the Toklat River (11,100 cy versus 7,500 cy.)

Cumulative Impacts: As described for Alternative 1, cumulative impacts to floodplains in the park have been moderate, with a minor impact due to administrative facility construction and a moderate impact from 80 years of placer-mining in the Kantishna Hills. The small but inconsequential effects of gravel extraction in the East Fork River and increased extraction at Toklat River would result in small additive effects to floodplains. Extraction with restoration at Downtown Kantishna and restoration at Glacier Creek would improve overall floodplain functions at these locations by grading out tailing piles, increasing stream sinuosity, and reintroducing vegetation in the floodplains. The overall cumulative effects to floodplains would remain moderate.

Conclusion: Alternative 2 would result in minor direct and indirect impacts to floodplains. The overall level of floodplain impacts under Alternative 2 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 3: Minimum Visual Intrusion/Long Hauls

Alternative 3 would result in a small increase in the extraction of gravel from the floodplain at the existing Toklat River site compared to the no-action alternative (from 7,500 cy to 11,100 cy.)

Cumulative Impacts: Cumulative impacts to floodplains would be similar as described for Alternative 1. The cumulative impacts to floodplains in the park have been moderate, with a minor impact due to administrative facility construction and a moderate impact from 80 years of placer mining in the Kantishna Hills.

Conclusion: Alternative 3 would result in negligible direct and indirect impacts to floodplains. The overall level of floodplain impacts under Alternative 3 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 4: Phased Development of Moderate Number of Sites *(NPS Preferred)*

Alternative 4 is virtually identical to Alternative 2 with respect to floodplain actions and potential impacts. Therefore, Alternative 4 would have short-term effects on small areas in the floodplains at Toklat River, East Fork River, and Downtown Kantishna. Effects at Downtown Kantishna may actually be beneficial to floodplain functions.

Cumulative Impacts: Cumulative impacts to floodplains would be the same as described for Alternative 2. Impacts to floodplains in the park have been moderate, with a minor impact due to administrative facility construction and a moderate impact from 80 years of placer mining in the Kantishna Hills. The small, inconsequential effects of gravel extraction in the East Fork River and increased extraction at Toklat River would result in small additive effects to floodplains. Extraction with restoration at Downtown Kantishna and restoration at Glacier Creek would improve overall floodplain functions at these locations. The overall cumulative effects to floodplains would remain moderate.

Conclusion: Alternative 4 would result in minor direct and indirect impacts to floodplains. The overall level of floodplain impacts under Alternative 4 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

Alternative 5 is identical to Alternative 4 with respect to floodplain actions and potential impacts. Therefore, Alternative 5 would have minor long-term effects on the floodplain at the Toklat River, East Fork River or Downtown Kantishna sites. Effects at Downtown Kantishna may actually be beneficial to floodplain functions.

Cumulative Impacts: Cumulative impacts to floodplains would be the same as described for Alternative 4. Impacts to floodplains in the park have been moderate, with a minor impact due to administrative facility construction and a moderate impact from 80 years of placer mining in the Kantishna Hills. Overall cumulative impacts to floodplains would remain moderate, but slightly improved.

Conclusion: Alternative 5 would result in minor direct and indirect impacts to floodplains. The overall level of floodplain impacts under Alternative 5 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

CULTURAL RESOURCES

None of the candidate gravel sites evaluated in this EA, except for Downtown Kantishna, are located close to known existing archeological or historical resource sites. As discussed in Chapter 1, one of the criteria the NPS used to identify potential material source sites within the park is that development of the source would not impact known or suspected important historical or archeological resources or their settings. The excavation/reclamation plan for Downtown Kantishna would not include work closer than 100 feet from the Busia Cabin on the southern part of the Moose #1 claim. The Busia Cabin was declared eligible for the National Register of Historic Places in 1983 by the State Historic Preservation Officer.

As reported in Chapter 3, the NPS has evaluated all of the candidate material sites as having negligible potential for the presence of an unrecognized significant historic or archeological resource. This conclusion is based on negative findings from surveys for the presence of significant historic properties or archeological resources, and on the observed attributes of site geomorphology and environmental setting. The NPS has determined there is not a need for further archeological survey or monitoring during source development. If cultural resources were uncovered during excavation at any of the material sites, however, would work be stopped and appropriate mitigation would be undertaken prior to resumption of borrow operations.

The status of prior archeological investigations for individual alternate material sources located outside the park is unknown. Collectively, these external material sources are situated within the upper Nenana River valley. This geographic region is distinguished by relict river terraces upon which are numerous archeological sites representing some of the earliest known human occupations in Alaska. Consequently, in lieu of area-specific archeological survey data, the inferred cultural resource potential of these material sources is presumed to be high. Archeological surveys would likely need to be completed before any of these existing sources could be significantly expanded, if that were necessary to meet the volume requirements for external gravel sources, or if any new sources outside the park were to be developed to meet park gravel needs.

Section 101(d)(6)(B) of NHPA requires consultation with federally recognized Indian tribes - basically, an invitation to be consulting parties in the identification and evaluation process. This provision is included to address properties that may be of traditional religious and cultural significance to Alaska Natives (i.e., Traditional Cultural Properties). Such properties may not be represented by the presence of tangible physical remains, but may exist as a geographic or landscape feature. This formal consultation process has not yet been initiated for any of the potential material sources.

Alternative 1: No Action

The NPS has already received cultural resource clearances for gravel extraction operations at the Teklanika Pit, Toklat River and North Face Corner sites. Future discoveries of cultural resources from operations at these sites are not anticipated. The potential for cultural resource finds at material sites outside the park is unknown, because the location and degree of disturbance cannot be determined. Alternative 1 requires by far the largest volume of material (over 200,000 cy) from external sources, however, so this alternative would involve the highest indirect disturbance to cultural resources not yet inventoried external to the park.

Cumulative Impacts: No adverse impacts have occurred to historic or archeological sites on public property along the park road or in the Kantishna area. In fact the NPS has restored historic log structures in the headquarters area and the Quigley cabin in Kantishna. The old Kantishna Roadhouse and other structures are being preserved at the lodge. No known listed cultural properties would be affected by this alternative. The overall cumulative impacts would be negligible.

Conclusion: Alternative 1 would result in negligible direct and indirect impacts to cultural resources in the park. The overall level of potential cultural resource impacts under Alternative 1 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 2: Maximum Flexibility/Short Hauls

The NPS has already received cultural resource clearances for gravel extraction operations at three existing sites inside the park, and has determined that the remaining six sites included in this alternative have negligible potential for the presence of unrecognized significant historic or archeological resources. New development at any of the latter six sites would not adversely affect known significant cultural resources or their settings. The listed Busia Cabin near the Downtown Kantishna extraction area would be avoided as described above. Therefore, operations under Alternative 2 would have negligible impacts on identified cultural resources and would not be likely to damage the integrity of undiscovered cultural resources within the park. The potential for cultural resource impacts at external material sites is unknown, but Alternative 2 requires a relatively small volume of material (projected at 12,500 cy in the cost analysis; see Appendix B) from external sources, and therefore would involve low potential for disturbance of resources not yet inventoried.

Cumulative Impacts: As described for Alternative 1, negligible and positive effects have occurred to cultural properties along the park road and no known cultural sites would be affected by this alternative. The overall cumulative impacts to cultural resources would be negligible.

Conclusion: Alternative 2 would result in negligible direct and indirect impacts to cultural resources in the park. The overall level of potential cultural resource impacts under Alternative 2 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 3: Minimum Visual Intrusion/Long Hauls

The NPS has already received cultural resource clearances for gravel extraction operations at three existing sites inside the park (including North Face Corner that would only be restored under this alternative). The NPS has determined that the remaining site (Moose Creek Terrace) included in this alternative has negligible potential for the presence of unrecognized significant historic or archeological resources. New development at the latter site would not adversely affect known significant cultural resources or their settings. Therefore, operations under Alternative 3 would have negligible impacts on identified cultural resources and would not be likely to damage the integrity of undiscovered cultural resources within the park. The potential for cultural resource impacts at material sites outside the park is unknown, but Alternative 3 requires a relatively large volume of material (approximately 120,000 cy) from external sources, and therefore would involve a relatively higher potential for disturbance of resources not yet inventoried. Overall, the impacts from Alternative 3 would be virtually the same as those for Alternative 1.

Cumulative Impacts: The overall cumulative impacts would be negligible and nearly identical to those described for Alternative 1.

Conclusion: Alternative 3 would result in negligible direct and indirect impacts to cultural resources in the park. The overall level of potential cultural resource impacts under Alternative 3 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 4: Phased Development of a Moderate Number of Sites (*NPS Preferred)*

The NPS has already received cultural resource clearances for gravel extraction operations at three existing sites inside the park, and has determined that the remaining three sites included in this alternative have negligible potential for the presence of unrecognized significant historic or archeological resources. New development at any of the latter sites would not adversely affect known significant cultural resources or their settings. Therefore, operations under Alternative 4 would have negligible impacts on identified cultural resources and would not be likely to damage the integrity of undiscovered cultural resources within the park. The potential for cultural resource impacts at material sites outside the park is unknown, but Alternative 4 requires a relatively small volume of material (estimated at 12,500 cy) from external sources, and therefore would involve low potential for disturbance of resources not yet inventoried. Overall, the impacts from Alternative 4 would be very similar to (but slightly less than) those for Alternative 2.

Cumulative Impacts: As described for Alternative 1, negligible and positive effects have occurred to cultural properties along the park road and no known cultural sites would be affected by this alternative. The overall cumulative impacts to cultural resources would be negligible.

Conclusion: Alternative 4 would result in negligible direct and indirect impacts to cultural resources in the park. The overall level of potential cultural resource impacts under Alternative 4 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

Alternative 5 involves essentially the same actions and impacts as Alternative 4, except for the substitution of the North Face Corner site for Moose Creek Terrace. Overall, the impacts from Alternative 5 would be virtually identical to those for Alternative 4 and would be negligible.

Cumulative Impacts: As described for Alternative 1, negligible and positive effects have occurred to cultural properties along the park road and no known cultural sites would be affected by this alternative. The overall cumulative impacts to cultural resources would be negligible.

Conclusion: Alternative 5 would result in negligible direct and indirect impacts to cultural resources in the park. The overall level of potential cultural resource impacts under Alternative 5 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

VISITOR USE AND EXPERIENCE

Park visitors in the vicinity of gravel acquisition operations would potentially be exposed to direct and indirect effects associated with those operations. In 1972 the NPS instituted its shuttle bus service and restricted private vehicles traveling past Savage River. Only visitors camping at Teklanika for a three-night minimum stay, Kantishna property owners, NPS staff, and individuals with special use permits are allowed to drive beyond the Savage River Check Station. There are three bus options for visitors who wish to drive into the park interior. The NPS shuttle, or visitor transportation service (VTS), travels between the park entrance and either Wonder Lake or the Eielson Visitor Center. The Tundra Wilderness Tour (TWT) travels to Mile 53. The Denali Natural History Tour (DNHT) makes

daily roundtrips to Mile 17 on the park road. (Because the DNHT trips only go a short distance beyond the Savage River check station, they are not counted against the 10,512-vehicle limit for the park road allocation period.) These transportation patterns largely determine the numerical distribution of visitors along the road corridor, and the number of visitors that might experience project activity at any given location.

According to the 1999 Park Road Traffic Report (NPS 2000) a total of 14,217 vehicles and 308,112 passengers traveled the park road in that year. Both were the highest numbers recorded to date. The GMP limits the number and types of vehicles allowed to transit the park road during the allocation period, which is from late May to mid-September. During the 1999 allocation period 12,649 vehicles and 289,916 passengers traveled the park road. Of those vehicles 36% were shuttle busses, 23% were tour buses, 26% were private vehicles, and 12% were NPS vehicles. The proportion of vehicles on the road during the GMP allocation period is roughly even by month during June (25% of the total), July (28%) and August (28%).

Table 4.9 provides the numbers of trips and passengers for each vehicle type, for both the entire year and the allocation period. Because no significant physical or management changes have occurred in the park since 1999, these data can be assumed to reflect current conditions on the park road. Furthermore, while no specific data are available on the distribution of visitor use along the park road beyond the Savage River Check Station, the distribution of the bus trips themselves provide a basic idea of visitor use patterns along the park road corridor. Most visitors taking a bus tour tend not to travel very far from designated bus stops. Therefore, because the three types of buses travel to various locations their frequency can be used as a key measure of most visitor use patterns in the park interior.

TABLE 4.9. NUMBERS OF VEHICLES AND PASSENGERS ON THE DENALI PARK ROAD

	VTS	TWT	DNHT	Private	NPS	Total
Total number of vehicles on the park road 1999	3,507	2,409	2,099			14,217
Total number of passengers on the park road 1999	97,350	107,930	17,308			308,112
Number of vehicles on the park road during the GMP allocation period 1999	3,507	2,214	1,893	2,519	1,443	11,576
Number of passengers on the park road during the GMP allocation period 1999	97,350	101,076	77,791	13,699		276,217

Table 4.9 does not include data for Kantishna lodge operations. Businesses in the Kantishna area typically run an average of less than two round trips per lodge per day for administrative and other purposes (NPS 1996). Kantishna lodge bus passengers were estimated at 9,814 in the same report. According to a 1999 EIS for the Spruce Creek Access, a conservative estimate of 7,000 people visit or reside in Kantishna from June to mid-September (NPS 1999). However, NPS staff report that Kantishna visitor numbers have increased in recent years to 9,000 or more per year.

Backcountry users must camp at least one-half mile away, and out of view, from the park road or any other developed area (including gravel extraction sites). According to 2001 NPS visitor statistics, more than 90% of the backcountry use occurred from May through August. The average backcountry visitor season is approximately 100 days. Based on this 100 day season and assuming 100% capacity,

most of the backcountry zones in which gravel acquisition, processing, and storing sites are proposed could expect an absolute maximum of 400 to 600 (depending on the zone-specific quota) backcountry users throughout the season.

In a visitor survey completed in 1998 (Miller and Wright 1998), park visitors were asked a number of questions regarding their experience using the parks transportation system and the impact of the system on enjoying the park resources. A majority of the visitors indicated that seeing wildlife was an important part of their trip. Approximately 70% of the visitors sampled rated the bus as a place for viewing wildlife as good or excellent. A minority of visitors thought that seeing other busses detracted from their enjoyment of the park. The overwhelming response of the visitors indicated that existing traffic levels on the road did not pose a problem. Visitors further indicated that that they did not perceive the traffic as an interference with their wildlife viewing experience. These survey responses are applicable to consideration of the cumulative impacts of the gravel acquisition activities on the visitor experience, particularly in relation incremental changes in park road traffic as a result of gravel hauling activity.

Alternative 1: No Action

Under this alternative, Teklanika Pit, Toklat River, and North Face Corner would remain the only approved material extraction sites along the park road. Neither the Teklanika nor Toklat River sites are visitor destinations or are part of exceptional viewsheds (NPS 1992). Visitors rarely venture close enough to the Toklat site to be adversely affected by work there. The Teklanika Pit area does not offer highly valued scenic attractions and is not frequently used as a hiker route. Based on these conditions, the NPS (1992) previously found that operations at these two sites would have negligible impacts on visitor use patterns in the areas of operation. The 1999 EA on expanding operation at the Toklat River site likewise concluded that the operations would have not have significant impacts on visitor use patterns in the area of operations.

The NPS (1999) EA for gravel acquisition at the North Face Corner site noted that operations at the screening plant would occur before the park road is open to bus traffic and before guests arrive at the Kantishna lodges. This would significantly reduce the impact of the noise generated during operations. Because of the timing of the proposed operations, the EA concluded that fewer than 100 visitors would be exposed to gravel processing operations in any season. The needs of the material crushing contract, however, mandated that the gravel pit operation started on August 19, and a much larger number of visitors were affected. Gravel extraction at North Face Corner would end by September 2003, so these effects would be short term.

The prior NPS environmental documents did conclude, however, that the proposed acquisition, processing and storage sites would increase the number of trucks on the park road needed to haul material to either storage sites or work sites along the road. These additional trips would increase noise and dust near the road and might contribute to lowered visitor satisfaction with the park. According to the cost analysis documented in Appendix B, the no-action alternative would generate an average of approximately 228,000 truck miles per year for hauling gravel. This represents the equivalent of approximately 16 percent of the vehicle miles generated on the park road by existing visitor and administrative traffic. This alternative would have the highest level of trucking activity among the five GAP alternatives. The machinery for both extracting and processing gravel would also be a source of noise and would occur at three existing extraction locations during hours of operation.

This alternative would likely produce about a 16 % increase in noise, exhaust, and dust production along the road corridor relative to current levels. The corresponding impacts to visitor use and

experience would be considered moderate. The effects of this activity on the visitor experience could be mitigated considerably by hauling gravel at night and/or during the shoulder seasons, to the extent practicable. Expanded use of dust palliatives on the park road could also reduce the amount of dust produced by the trucking activity.

Cumulative Impacts: The 228,000 miles of trucking activity with its noise and dust emissions would be added to the ongoing 1,481,000 miles of visitor bus and administrative vehicle travel. The 16 % increase in large vehicle travel on the park road would have periodic short term but widespread impacts to visitor experiences. The overall cumulative impacts would be moderate.

Conclusion: Alternative 1 would result in moderate direct and indirect impacts to visitor use and experience in the park.

Alternative 2: Maximum Flexibility/Short Hauls

This alternative would authorize extraction of mineral material from up to eight sites and the use of North Face corner for stockpiling and processing material. Two of the proposed sites, Teklanika Pit and Toklat River, are currently authorized for borrow production. The six new sites would be East Fork River, Beaver Pond, Boundary, Camp Ridge, Downtown Kantishna, and Kantishna Airstrip.

Increased dump truck and heavy equipment activity near the extraction sites and/or along the park road could affect the perception visitors have of the park and their recreational experience. Gravel hauling might occur at any time during the summer months. A slight degradation of visitor experience from these trucks might be expected. Under this alternative, however, the number of proposed sites would minimize haul distances and truck traffic. This alternative would generate approximately 110,000 truck miles a year, equivalent to 7 percent of total current annual vehicle miles generated by visitor and administrative traffic on the park road.

The gravel sites themselves would increase the distribution of human and industrial activity along the park road, particularly in the Kantishna area (see the Scenic Values section). Alternative 2 has the most proposed sites and it also has the most proposed sites that could be operating simultaneously during the summer season, creating human disturbance at more locations along the road corridor. The potential effects on wildlife viewing from the park road would probably be transient, however, and would be felt locally only when work was in progress.

Campers in the park campgrounds would be negatively affected only if the proposed sites were in sufficient proximity to campgrounds. The Teklanika campground is approximately 2 miles from the Teklanika Pit. Campers at Teklanika would be unlikely to experience additional noise from site operations, but they might notice increased traffic from trucks hauling material to repair sites along the road. The other proposed site that is relatively close to a campground is the Boundary site, which is located approximately 1,500 feet north of Wonder Lake. The Wonder Lake campground is located at the southern end of the lake, an additional 1.5-mile distance and lower in elevation. Noise from operations at the site might reach campers, but more likely the presence of trucks and the visual intrusion when entering and leaving the area would be the primary influence on their experience.

This alternative would not significantly affect backcountry users of the park. The draft backcountry management plan for the park allows few people per night per backcountry unit, and regulations require users to camp at least a half mile away, and out of view, from the road corridor and development sites. Given the size of each unit and the number of people allowed, backcountry users

should have no difficulty dispersing to pristine areas, away from the road corridor, that offer a quality wilderness experience.

Day hikers in the park should be minimally affected by this alternative. Most of the developed trails in the park are in the entrance area and are far away from any of the proposed gravel sites. There are also short trails near the Eielson Visitor Center, but operations noise at the proposed Beaver Pond site should not be audible from the center and the trail. Visitors who day hike off trail near one of the proposed sites may be subjected to noise or visual intrusions. The size of the park and park road, however, would make it easy for visitors to hike without encountering any of the proposed sites.

Processing and stockpiling activities at the North Face Corner pit would be visible and audible to users of the park road in that area, including all visitors to Kantishna. Gravel mining and reclamation activity at the Downtown Kantishna site would be evident to visitors at the Kantishna Roadhouse and Denali Backcountry Lodge. Noise, work at the sites, vehicle activity and fugitive dust associated with gravel acquisition work could affect the way these visitors perceive the character of the park.

Alternative 2 would affect more visitor experiences than Alternatives 3 through 5. This alternative includes the highest number of sites to be operated (9) and would create more gravel extraction activities that would be audible to campers and hikers. However, Alternative 2 would generate fewer truck miles on the park road than Alternatives 1 and 3 and approximately the same amount as Alternatives 4 and 5.

Alternative 2 would not affect visitor use patterns within the park and the effects on visitor experiences would likely be short-term and transitory over small areas, except for those staying at Kantishna area lodges. The overall impacts on visitor use and experience with this alternative would be minor. The effects of this alternative on visitor use and experiences could be mitigated considerably by hauling gravel at night and/or during the shoulder seasons, to the extent practicable. Expanded use of dust palliatives on the park road could also reduce the amount of dust produced by the trucking activity.

Cumulative Impacts: The 110,000 miles of trucking activity with its noise and dust emissions would be added to the ongoing 1,481,000 miles of visitor bus and administrative vehicle travel. The 7 % increase in large vehicle travel on the park road would have periodic short term but widespread impacts to visitor experiences. Alternative 2 would create a small incremental increase to the number and extent of developed sites within the park road corridor. The overall cumulative impacts are judged to be minor.

Conclusion: Alternative 2 would result in minor direct and indirect impacts to visitor use and experience along the park road corridor.

Alternative 3: Minimum Visual Intrusion/Long Hauls

This alternative involves maintaining two of the current three approved material extraction sites and adding one new site, at Moose Creek Terrace, to produce material for use on the western end of the road. Truck traffic and noise would be the feature of this alternative most evident to visitors. Because this alternative proposes only three sites within the park and requires a substantial amount of gravel to be brought in from outside the park, total gravel hauling activity would be highest among the four action alternatives. The potential effects on wildlife viewing from the park road would probably be transient and would be felt locally only when work was in progress.

Alternative 3 would generate an average of approximately 175,000 truck miles per year for gravel hauling. This represents the equivalent of approximately 12 percent of the total vehicle miles currently produced on the park road by visitor and administrative traffic. Truck traffic would be greater for this alternative than Alternatives 2, 4 or 5, but less than Alternative 1. The incremental change would likely be minor relative to the current volume of traffic, however, and would likely not be noticeable to park visitors. Furthermore, a 1998 visitor survey indicated that bus passengers did not, in general, perceive a problem with the amount of road traffic.

Under this alternative, material for road segments 1 through 4 would come mostly from external sources. Because of this the number of trucks hauling the material would increase substantially. There is a smaller visitor presence at the western end of the road and a larger presence at the east end. Because of this, increased truck traffic in the first four road segments would have a larger impact relative to road segments further west, as more visitors are present in the eastern part of the road corridor.

The potential for impacts on camping and hiking due to noise and visual intrusion (see impacts on viewshed) near the extraction sites would be lowest under this alternative, because only three sites would be used for gravel extraction.

Noise from equipment operating at the proposed Moose Creek Terrace site would probably reach visitors at Camp Denali and North Face Lodge. People hiking along Moose Creek would hear the equipment operation because they follow the Moose Creek mining access road from North Face Lodge. Hikers could hear the gravel operation all the way from North Face Lodge for the mile to the site and at least a mile farther upstream. Hikers on the popular Moose Creek route would be exposed to views of the operation as they approached the site.

The effects of this alternative on the visitor experience could be mitigated considerably by hauling gravel at night and/or during the shoulder seasons, to the extent practicable. Expanded use of dust palliatives on the park road could also reduce the amount of dust produced by the trucking activity.

Cumulative Impacts: The 175,000 miles of trucking activity with its noise and dust emissions would be added to the ongoing 1,481,000 miles of visitor bus and administrative vehicle travel. The 12 % increase in large vehicle travel on the park road would have periodic short term but widespread impacts to visitor experiences. Considering the ongoing and additional vehicular traffic under this alternative, the overall cumulative impacts to visitors would be moderate.

Conclusion: Alternative 3 would result in moderate direct and indirect impacts to visitor use and experience along the park road corridor.

Alternative 4: Phased Development of Moderate Number of Sites (*NPS Preferred)*

This alternative would distribute the operation of the permitted sites temporally as well as spatially. Extraction at the East Fork River and Toklat River sites is scheduled for operation only in the spring and fall, before and after the bulk of summer visitation. Because Moose Creek Terrace would only be developed after the Downtown Kantishna site has been exhausted, only one gravel operation would be evident to visitors in the Kantishna area at any given time. The other sites would operate during the summer season as needed.

Noise from equipment at the proposed Moose Creek Terrace site might reach visitors at Camp Denali and North Face Lodge. People hiking along Moose Creek would hear the equipment operation because they follow the mining access road from North Face Lodge. All hikers heading up Moose Creek would hear the operation all the way from North Face Lodge for the mile to the site and at least a mile farther upstream. As discussed for Alternative 2, gravel mining and reclamation activity at the Downtown Kantishna site would be evident to visitors at the Kantishna Roadhouse and Denali Backcountry Lodge.

Potential impacts to visitors camping, hiking and backpacking would be the same as reported for Alternatives 2 and 3. Because the proposed sites would not all be operating simultaneously, however, impacts in this case would be of less magnitude than Alternative 2.

This alternative would generate approximately 106,000 truck miles per year for gravel hauling, equivalent to 7 percent of the current total vehicles miles from visitor and administrative traffic on the park road. This presence would be considerably less than Alternatives 3 and 1. The effects of this alternative on visitor use and experiences could be mitigated considerably by hauling gravel at night and/or during the shoulder seasons, to the extent practicable. Expanded use of dust palliatives on the park road could also reduce the amount of dust produced by the trucking activity.

Cumulative Impacts: The 106,000 miles of trucking activity with its noise and dust emissions would be added to the ongoing 1,481,000 miles of visitor bus and administrative vehicle travel. The 7 % increase in large vehicle travel on the park road would have periodic short-term impacts to visitor experiences that would be commensurate with existing levels of truck traffic. Alternative 4 would create a small incremental increase (3 new sites) to the number and extent of developed sites within the park road corridor. The overall cumulative impacts to visitor uses and experiences are judged to be minor.

Conclusion: Alternative 4 would result in minor direct and indirect impacts to visitor use and experiences in the park.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

The impacts of Alternative 5 on visitor use and experience would be very similar to those identified for Alternative 4. The primary difference in impacts would be due to the use of North Face Corner instead of Moose Creek Terrace in the second phase of Alternative 5. This alternative would generate approximately 105,000 vehicle miles per year for hauling gravel, equivalent to 7 percent of the total annual vehicle miles generated by visitor and administrative traffic on the park road. The level of gravel hauling activity would be virtually the same as for Alternative 4.

Utilizing North Face Corner instead of Moose Creek Terrace would result in exposure to gravel operations for a greater number of Kantishna area visitors. The North Face Corner pit would be visible and audible to all users of the park road in that area, including all visitors to Kantishna. As

discussed for Alternatives 2 and 4, gravel mining and reclamation activity at the Downtown Kantishna site would be evident to visitors at the Kantishna Roadhouse and Denali Backcountry Lodge. Noise, work at the sites, and vehicle activity and fugitive dust associated with these operations would affect the way visitors perceive the character of that portion of the park.

Because of the greater exposure of the North Face corner site to Kantishna visitors, impacts on visitor use and experience from this alternative would be slightly greater than those impacts for Alternative 4. Overall, however, based on the balance between impacts at the specific source sites and along the road corridor, the level of impacts would likely be considered minor. The effects of this alternative on visitor use and experiences could be mitigated considerably by hauling gravel at night and/or during the shoulder seasons, to the extent practicable. Expanded use of dust palliatives on the park road could also reduce the amount of dust produced by the trucking activity.

Cumulative Impacts: The 105,000 miles of trucking activity with its noise and dust emissions would be added to the ongoing 1,481,000 miles of visitor bus and administrative vehicle travel. The 7 % increase in large vehicle travel on the park road would have periodic short-term impacts to visitor experiences that would be commensurate with existing levels of truck traffic. Alternative 5 would create a small incremental increase to the number and extent of developed sites (2 new sites) within the park road corridor. The overall cumulative impacts to visitor uses and experiences are judged to be minor.

Conclusion: Alternative 5 would result in minor direct and indirect impacts to visitor use and experience in the park.

SCENIC VALUES

Visitors to the park would potentially be exposed to views of land disturbance and operations activities at the gravel extraction and processing sites. The physical changes to the landscape could affect the scenic quality of the landscape as perceived by visitors. Evidence of human industrial activity, such as equipment operations at the gravel sites and increased truck traffic along the park road, could also intrude on visitors' experience and their perception of the scenery and wildlife viewing opportunities. The extent and intensity of the potential effects on scenic values would depend largely on the degree of additional disturbance introduced by the gravel operations. It would also depend upon the number and sensitivity to change of the visitors exposed to those conditions, which would vary among the park users groups and their distribution within the park. This section of the EA provides an assessment of the potential visual effects of the gravel acquisition plan on the scenic values of the park. A discussion of site-specific effects at the candidate gravel sites is followed by a summary of potential effects on scenic values for each plan alternative. As a key measure of potential effects on scenic values, Table 4.10 provides estimates of the approximate linear distances along the park road from which each site would likely be visible.

TABLE 4.10 EXTENT OF EXTRACTION SITE VISIBILITY FROM THE PARK ROAD

Extraction Site	Approximate Length of Park Road with Visual Access to Site				
	Alternative 1 No Action	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
Teklanika MP 27.2: Visible from park road; transitory view from bridge; not visible from pullout/rest stop overlooking Teklanika River or from Teklanika Campground.	27.0-27.7=**0 .7**	27.0-27.7=**0 .7**	27.0-27.7=**0.7**	27.0-27.7=**0 .7**	27.0-27.7=**0 .7**
East Fork MP 43: Visible from park road due topography and downward travel directed toward site; not visible from Polychrome Pass.		42.5-44.5=2**.0**		42.5-44.5=2**.0**	42.5-44.5=2**.0**
Toklat MP 53.4: Visible from park road; views from the Toklat rest stop are blocked by topography; also, visible from the Toklat Bridge.	52.9-53.06=**0.7**	52.9-53.06=**0.7**	52.9-53.06=**0.7**	52.9-53.06=**0.7**	52.9-53.06=**0.7**
Beaver Pond MP 70: Visible at various points along the park road; not visible from the Eielson Visitor Center.		68.5-72.=3**.5**		68.5-72.0=3**.5**	68.5-72.0=3**.5**
Boundary MP 88: Visible from park road; the design would eliminate visibility form Camp Denali and North Face Lodge.		87.8-88.2=**0.4**			
Moose Creek Terrace MP 89: Not visible from the park road, but visible from side roads in Moose Creek Valley, which is frequented by hikers and North Face Lodge and Camp Denali guests.			Not visible from park road.	Not visible from park road.	
North Face Corner MP 89: Visible from the park road, Camp Denali and North Face Lodge.	88.8-89.6=**0.8**				88.8-89.6=**0.8**
Camp Ridge MP 90: Visible from the park road, Camp Denali and North Face Lodge.		89.4-90.2=**0.8**			
Downtown Kantishna MP 91: Visible from the Park Road, Camp Denali, and North Face Lodge.		90.5-92.0=**1.5**		90.5-92.0=**1.5**	90.5-92.0=**1.5**
Kantishna Airstrip MP 93: Visible from Lower Moose Creek Trail, Jauhola Road, and residences on hillside to south.		Not visible from park road.			
TOTAL	**2.2 miles**	**9.6 miles**	**1.4 miles**	**8.4 miles**	**9.2 miles**

As discussed previously in the Visitor Use and Experience section, the primary park user groups include people riding shuttle buses or tour buses along the park road, visitors staying in park campgrounds, backcountry users (primarily backpackers), day hikers in the front country, and visitors staying at the Kantishna lodges. In number, bus riders comprise by far the largest group. A relatively small portion of this group travels to the west end of the park road, or at least to the Wonder Lake area near the west end. Based on the configuration of the park shuttle and tour bus systems, most riders travel no farther than the Eielson Visitor Center at Mile 66, and many remain within the eastern 17 miles of the road corridor.

Backcountry campers are regulated by limits on the number of visitors allowed in backcountry zones (see Visitor Use section of this EA). Most of the zones near the park road have a daily quota of four to six visitors, which would serve to minimize viewer exposure to gravel extraction sites among this user group. In addition, backcountry visitors must camp at least one-half mile and out of view from the park road or any other developed area, including gravel extraction sites. Therefore, it is not likely that any gravel sites would be visibly exposed to backcountry camps. Most hiking trails are located near the park entrance, where no gravel sites are proposed, and most hiking is done across open terrain where hikers can choose to avoid the vicinity of gravel extraction areas.

In a visitor survey completed in 1998 (Miller and Wright 1998), visitors were asked a number of questions regarding their experience using the park transportation system and the impact of the system on enjoying the park resources. The majority of the visitors indicated that viewing wildlife was an important part of their trip and that traffic on the road did not adversely affect their viewing experience. Visitors also indicated that traffic did not interfere with their wildlife viewing experience.

Potential Effects at Gravel Source Sites

Teklanika Pit

Currently, a portion of this site is in use as a borrow pit and a portion has been abandoned. Because the terrain rises from the park road to the site, the pit area is not evident from the road, although the top of a pit wall can be distinguished. Bulldozers push overburden material toward the southeast side of the site for use in revegetation of previously disturbed areas and to screen views of the site from the road.

Under Alternative 2, 4 or 5, excavation at this site would be expanded to the north and west, toward the park road. Views to the south from the road could include scars from excavation, as well as heavy equipment and dust during times of active pit operations. Most of the processing and stockpiling would continue to occur during the summer (the main visitor season), as needed. The south and north pit walls would be reclaimed as excavation progressed to the northeast. Priority would be placed on the north wall because it is slightly visible from the road through a partial screen of spruce trees. Slopes would be recontoured and organic overburden would be spread to hasten natural recovery.

It is not common for vehicles to stop for viewing opportunities at this location, and this site is not near any park visitor facilities. A pullout overlooking the Teklanika River is 1.4 miles east of the pit site and the Teklanika Campground is 1.8 miles west of the site; the pit is not visible from either location. While landscape disturbance and operations activity at the Teklanika Pit could be visible in the foreground to a large portion of park road travelers during the long-term operating period for this site, their view of the pit site would be quite brief and transitory. Moreover, the evidence of human disturbance would represent a small change in an expansive landscape. With restoration of the site following closure, the changes to the landscape would not be permanent. Based on these

considerations, expanded operations at the Teklanika Pit would have a subtle and minor temporary effect on scenic values in the adjacent area or the road corridor in general.

Toklat River

The Toklat River site is currently used for excavation of accumulated gravel from within the existing river channel. Natural stream processes eliminate visible evidence of the excavations within a relatively brief period. Processing and stockpiling occurs north of the NPS Toklat Camp housing equipment and storage area, which has introduced evidence of human modification into the local landscape. The Toklat rest area is adjacent to the park road on the west bank of the river, approximately 0.75 mile to the south of the site, but views from the rest area toward the extraction site are blocked by topography. This site is visible in the distance from the park road and the Toklat River bridge. As a result, viewing experiences (natural vista and foreground view) would continue to be altered by ongoing operation at this site. Extraction activities would occur mostly before or after the main visitor season to minimize visual impacts during high-use periods. In addition, the site is not a visitor destination area or part of an exceptional viewshed (NPS 1999). Material processing could occur at any time during the season, either by contractor or NPS staff. Based on the typical viewing distance to this site, the existing degree of landscape modification, the proposed timing of gravel operations and the ability of the river to remove evidence of the mirror-channel cuts, scenic values in the vicinity of the Toklat River site would not be changed by continued gravel operations.

East Fork River

To the west of the East Fork site the park road climbs away from the river and crosses the lower portion of an open slope before turning west toward Polychrome Pass. Excavation activities and equipment would be visible in middleground views for travelers along the park road. Views of operations at the East Fork site would be more prominent for eastbound viewers than for westbound traffic, as their direction of travel would be downward and directed toward the site. Excavation would occur in accumulated gravel near the east bank of the river, and the mirror-channel cuts would be reclaimed through natural stream flow processes. Scenic values along a portion of the park road would be diminished during intermittent periods of active operations at this site. However, extraction activities would occur mostly before or after the main visitor season to avoid viewshed impacts during high-use periods, unless the need was during a road emergency. Based on the expected timing of the proposed operations and the limited numbers of viewers likely to be present, impacts on scenic values in the vicinity of the East Fork River site are expected to be minor.

Beaver Pond

The Beaver Pond site is the location of a former borrow pit. Some excavated areas are now covered in shrubs and grasses. The existing surface disturbance at this site is not highly visible from the park road. The new extraction area would be visible from various points along the road, primarily at distances of about one-half mile or more. Processing and storage would occur in the middle of the lower end of the extraction area to minimize visibility from the road. Overburden would be pushed toward the east side of the pit to obstruct views of the extraction area from the road. The Beaver Pond site would be operated as needed, although most of the processing and stockpiling would occur in the spring or fall when visitor use of the park is low. Following closure of the site, reclamation would be accomplished by contouring the pit slopes to a 2:1 grade to blend with the surrounding topography and spreading organic overburden to hasten natural recovery. With restoration of the site, the changes to the landscape would eventually be difficult to identify.

Thorofare Cabin, used by NPS patrol staff, is below the site to the west. However the site is not visible from the cabin. The site is also about 3 miles from a common route that provides access to Green Point and the Anderson Pass backcountry area. The Beaver Pond site would be slightly visible in the midground vistas of hikers in the backcountry, as would the park road in this area. This site is west of the Eielson Visitor Center, and most park visitors do not travel this far west on the park road. While the periods of excavation and processing are expected to be short and transitory at the site, stockpiling and project uses are expected to be continuous over the period of the plan. Based on the transitory nature of views to the Beaver Pond site for park road travelers, operating measures that would be employed to screen views, and the temporary period of continuous excavation and processing operations at this site, impacts on scenic values in this area of the road corridor are expected to be minor to moderate.

Boundary

The Boundary site is also a former borrow pit. Some formerly excavated areas are now covered in shrubs and grasses. A bus parking area and gravel stockpiles are near the entry to the former pit access road. The new extraction area would be defined and developed to minimize visual impacts from the park road. The design would eliminate visibility from Camp Denali and the North Face Lodge. Overburden would be pushed to the north side of the pit to obstruct views onto the extraction and processing area. During the reclamation process, slopes would be contoured to a 2:1 grade, blended with the surrounding topography, and organic overburden would be spread to hasten natural recovery. This site would be operated as needed, although most of the processing and stockpiling would occur in the spring or fall when visitor use of the park is low. Based on the relatively low number of potential views of the Boundary site, operating measures that would be employed to screen views, and the temporary period of operation for this site, impacts on scenic values in this area of the road corridor are expected to be minor.

Moose Creek Terrace

The Moose Creek Terrace site is above the south banks of Moose Creek and is not visible from the park road, although it is clearly visible from a secondary road that winds through the Moose Creek valley. Guests of the North Face Lodge, Camp Denali, Denali Backcountry Lodge and/or Kantishna Roadhouse walk through this area daily, including participation on guided hikes. Processing and stockpiling would be on a lower terrace to reduce visibility to hikers. The site would be operated throughout the main visitor season as needed, although most of the processing and stockpiling would occur in the spring or fall when visitor use of the park is low. Use of the site would require upgrading the road to the site and a new visitor parking area and trail may be constructed on the east side of the processing area. The quality of views experienced by visitors using the Moose Creek valley would be diminished on a long-term basis by the evidence of gravel extraction and processing at this site. Because visitors typically access this area on foot, the duration of those views would be relatively long. However, based on the relatively low number of affected viewers and the proposed seasonal operating patterns for the major excavation and processing work, impacts on scenic values in the Moose Creek area are expected to be minor to moderate.

North Face Corner

The North Face Corner site is adjacent to the south side of park road and is part of the gravel benches lining the south side of Moose Creek. The site is about 400 feet northwest of the North Face Lodge and about 1,400 feet southwest of Camp Denali. This site is an active pit and has been developed by cutting away at the slope adjacent to the uphill side of the Denali Park Road. The park road would be realigned to eliminate a safety corner after reclamation.

The site would continue to be fully visible from the park road, the North Face Lodge, and the Camp Denali cabins. Processing and vehicle activity, including fugitive dust, would affect the visual experience of park visitors on the road and at the lodge and cabins. Views of overburden stockpiles would continue to detract from the natural visual character of the landscape. Extraction activities would continue to impose on viewsheds and alter natural vistas, adversely affecting the visitors' perception of the park as a "wilderness." Processing and storage would be located at the western portion of the site to reduce their visibility. The site would continue to have an industrial look, including a screening plant and rock crusher, until final recontouring and revegetation work established a terraced edge profile and connection to the rest of the landscape. The site would be operated throughout the main visitor season as needed, although most of the processing and stockpiling would occur in the spring or fall when visitor use of the park is low.

While the North Face Corner site is now an active gravel pit, expanded operation would further degrade visual conditions near this site. Based on the visual presence of site disturbance and operations in the immediate foreground for all travelers on the park road in this area and the proximity to two lodges, impacts on scenic values in this area are expected to be moderate.

Camp Ridge

The Camp Ridge site is adjacent to the eastern side of the park road near the crossing of Moose Creek. This site is plainly visible from vehicles traveling on the park road and by guests of the North Face Lodge and Camp Denali, who often walk along this section of road. Extraction and processing activities at Camp Ridge would be fully visible from the park road. Most views from the road would be quite brief, limited to the time required for a vehicle to pass by the site, although this would not be the case for lodge visitors walking along the road. Processing and vehicle activity, including fugitive dust, would detract from the natural visual character of the landscape. Evidence of human development in the Kantishna area is common, although the local viewshed has a predominantly natural appearance. A key impact factor for this location is that relatively few park visitors travel this far west; only two park shuttle buses per day travel beyond Wonder Lake, so most potential viewers of the Camp Ridge site would be Kantishna-area lodge guests. In addition, most of the processing and stockpiling activity at this site would occur in the spring or fall, when visitor use of the park is low. Based on consideration of visitor numbers and seasonal timing of operations, impacts on scenic values in the area surrounding Camp Ridge are expected to be minor.

Downtown Kantishna

The Downtown Kantishna site is composed of several former placer mining claims that are bounded by Moose Creek to the east, the Kantishna Roadhouse and Denali Backcountry Lodge to the south and north, and steep slopes to the west. Processing and storage would be in the middle of the pit area to reduce visibility from park road and the lodges. In addition, berms or gravel stockpiles would be created on the south and north sides of the pit to screen views. After the mining process is completed, slopes would be contoured to match surrounding grades and to produce meandering channels in Eldorado Creek and Moose Creek.

This site would be operated as needed. However, most of the processing and stockpiling would occur in the spring or fall, when visitor use of the park is low. Gravel processing operations, including heavy equipment and stockpiles, would be visible from the park road, the Kantishna Roadhouse, and the Denali Backcountry Lodge. Dust would be generated during periods of gravel crushing and hauling. A bridge over Moose Creek would be needed to allow heavy equipment access to the site. Bridge construction would temporarily disturb views along the creek, and the bridge would be visible from the local lodges. Viewing experiences would be adversely affected and the visitors' perception

of the park as a "wilderness" would be degraded. However, the visual effect would be limited to foreground views of a site that is commonly known to have been previously disturbed by placer mining. Because the site would be so visible to visitors traveling above it on the park road, however, impacts on scenic values near the Downtown Kantishna site are expected to be moderate.

Kantishna Airstrip

This site is parallel to the Kantishna Airstrip, the Lower Moose Creek Trail, and historic Jauhola Road. The site is not visible from the park road, which ends a short distance to the south, or the Kantishna Airstrip. However, it is visible from the trail, Jauhola Road, and a residence on hillside about three-quarters of a mile to the south. To reduce visibility, processing and storage would be in the middle of the pit area or near the south edge. This site would be operated as needed, although most of the processing and stockpiling would occur in the spring or fall, when visitor use of the park is low. Views that include this site would be adversely affected by the evidence of disturbance. However, the adjacent portions of this viewshed contain a number of existing development features, including the airstrip, the airstrip access road and an historic cabin. Based on the relatively low numbers of potential viewers present near this site and the degree of landscape modification, impacts on scenic values near the Kantishna Airstrip are expected to be minor.

Alternative 1: No Action

Continued use of the approved material extraction sites at Teklanika and the Toklat River, and minimal extraction at the North Face Corner site would continue to alter natural viewsheds and create dust that could slightly degrade the viewing experience of major visitor groups. All three of the existing sites are visible to some degree from the park road, for a combined distance of approximately 2 miles. The North Face Corner site would be restored, however, after 2003. Truck and heavy equipment traffic on the park road would also detract from the viewing experience. However, only three sites would be in use and they are located away from the highest-use areas of the park. Impacts to scenic values resulting from reliance on external gravel sources, and the associated increase in truck activity, might be similar to those discussed above, although they would likely occur within a landscape that has more evidence of existing development. Under Alternative 1, visual impacts would be low and impacts on scenic values along the road corridor are expected to be minor.

Cumulative Impacts: Opportunities to view scenery and wildlife from the Denali Park Road are generally recognized to be excellent because few visible developments occur along the park road corridor. The limited change in scenic values would not represent a new type of landscape modification and would be a negligible impact in the context of existing landscape modification. The overall cumulative impacts on scenic values would be minor.

Conclusion: Alternative 1 would result in minor direct and indirect impacts to scenic values in the park. The overall level of potential impacts to scenic values under Alternative 1 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 2: Maximum Flexibility/Short Hauls

Use of eight extraction sites (Teklanika, East Fork River, Toklat River, Beaver Pond, Boundary, Camp Ridge, Downtown Kantishna and Kantishna Airstrip) and the North Face Corner site for processing and stockpiling gravel would alter natural viewsheds and create dust that could degrade

the viewing experience of major viewer groups. Seven of the extraction sites and North Face Corner are at least partially visible from the park road; the combined distance of potential view exposure along the road is estimated at 9.6 miles. Truck and heavy equipment traffic on the park road would also detract from the viewing experience. This alternative represents the greatest degree of incremental intrusion to viewsheds along the park road. However, this alternative would minimize gravel hauling, and would thereby result in less impact of this type to viewing experiences. No new proposed gravel sites would be located in the eastern end of the road corridor, where the concentration of visitors is greatest.

Visual impacts resulting from the use of external gravel sources would be similar in nature to those discussed above for Alternative 1, although Alternative 2 would have minimal reliance on external material sources. Overall, Alternative 2 would likely result in long-term, localized landscape changes at a relatively high number of sites. Based on the distribution of the sites and their location within the developed area of the park, overall impacts on scenic values within the road corridor or the park in general are expected to be moderate.

Cumulative Impacts: Opportunities to view scenery and wildlife from the Denali Park Road are generally recognized to be excellent because few visible developments occur along the park road corridor. The addition of six new gravel extraction sites, five along the western end of the park road, would result in long-term, local impacts to scenic values, or moderate impacts. For these reasons the overall cumulative impacts of Alternative 2 on scenic values are expected to be moderate.

Conclusion: Alternative 2 would result in moderate direct and indirect impacts to scenic values in the park. The overall level of potential impacts to scenic values under Alternative 2 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 3: Minimum Visual Intrusion/Long Hauls

This alternative would result in new development at the Moose Creek Terrace site, which would be considered a major extraction site, and continued operation of two existing sites. At all three sites, gravel processing would alter the natural viewshed and create dust that could slightly degrade the viewing experience of major viewer groups. However, only three sites would be in use and all are located away from the highest park use areas. In addition, the Moose Creek site is not visible from the park road. The other two sites are visible from the park road for a combined distance of about 1 mile. The relatively long haul distances for this alternative would result in a comparatively large increase in truck and heavy equipment traffic on the park road for a longer duration, which could detract from the viewing experience of major viewer groups. Overall, visual impacts from Alternative 3 are expected to be minor.

Cumulative Impacts: Alternative 3 would have similar cumulative effects to scenery as Alternative 1, except this alternative would have one new site at Moose Creek Terrace. The overall cumulative impacts on scenic values would be minor.

Conclusion: Alternative 3 would result in minor direct and indirect impacts to scenic values in the park. The overall level of potential impacts to scenic values under Alternative 3 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 4: Phased Development of Moderate Number of Sites *(NPS Preferred)*

Visual impacts under Alternative 4 would be similar to those described above for Alternative 2, although gravel operations would occur at two fewer sites. Use of six extraction sites would alter the natural viewshed and create dust that could slightly degrade the viewing experience of major viewer groups. However, no sites would be located in the eastern end of the road corridor, where the concentration of visitors is greatest. Phased development would minimize viewshed impacts because fewer sites would be operational at any one time. Five of the proposed extraction sites in Alternative 4 are visible from the park road, for a combined distance estimated at approximately 8.4 miles. Alternative 4 would generate a relatively small increase in truck traffic on the park road, with corresponding minor effects on viewers. Overall visual impacts from Alternative 4 would be slightly less than those discussed for Alternative 2. Based on the distribution of the sites and their location within the developed area of the park, impacts on scenic values within the road corridor or the park in general are expected to be moderate.

Cumulative Impacts: Opportunities to view scenery and wildlife from the Denali Park Road are generally recognized to be excellent because few visible developments occur along the park road corridor. The addition of three new gravel extraction sites would result in long-term, local impacts to scenic values. For these reasons the overall cumulative impacts of Alternative 2 on scenic values are expected to be moderate.

Conclusion: Alternative 4 would result in moderate direct and indirect impacts to scenic values in the park. The overall level of potential impacts to scenic values under Alternative 4 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

Under Alternative 5, viewshed impacts would be similar to those discussed under Alternative 4 because the major difference would be use of the North Face Corner site instead of the Moose Creek Terrace site. Visual impacts in this case would include the continued high visibility of the North Face Corner site. Based on the previous reasoning, Alternative 5 would be expected to result in moderate overall impacts on scenic values.

Cumulative Impacts: Opportunities to view scenery and wildlife from the Denali Park Road are generally recognized to be excellent because few visible developments occur along the park road corridor. The addition of two new gravel extraction sites would result in long-term, local impacts to scenic values. For these reasons the overall cumulative impacts of Alternative 2 on scenic values are expected to be moderate.

Conclusion: Alternative 5 would result in moderate direct and indirect impacts to scenic values in the park. The overall level of potential impacts to scenic values under Alternative 5 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

PUBLIC ACCESS AND SAFETY

The currently approved in-park gravel sources are inadequate in volume to support maintenance and rehabilitation needs for the park road and the development projects identified in the Frontcountry Plan. There is concern that poor roadway conditions at many locations in the western part of the park road represent potential safety risks for park visitors and administrative employees. Consequently, a key issue for the evaluation of the alternative gravel acquisition plans is their ability to support public access and safety needs, specifically in relation to the continued ability to provide for comfortable and safe access to the interior of the park along the park road. In general, the four action alternatives for the plan would adequately support maintenance and rehabilitation needs for the park road, and would thereby contribute to meeting public access and safety needs.

As discussed in Chapter 1, potential safety hazards from gravel extraction, processing and hauling operations are also a pertinent concern for this topic area. All of the GAP alternatives would involve various types of risks to workers and (in some cases) the visiting public associated with development of high walls at upland extraction sites, operation of heavy equipment for gravel extraction and processing, fuel storage at extraction and processing sites, and operation of heavy trucks for hauling gravel from source sites to places of use along the park road corridor. While the risks to workers would be somewhat variable among alternatives based on location and organization (i.e., NPS or contractor/supplier personnel) the overall worker-safety risk should be approximately equal among alternatives because the total volume of material would be the same. Furthermore, it is expected that risks to workers would be minimized through standard NPS and private-sector safety practices and worker-safety regulations. Consequently, the following discussion addresses potential operational safety issues only to the extent that they are specific to a given alternative or site.

Alternative 1: No Action

Under Alternative 1, in-park gravel production would be insufficient to meet the material demand for road maintenance and construction over the next 10 years. The result would be reliance on external sources for nearly two-thirds of the gravel needs and likely a 16 % increase in annual vehicle miles traveled on the park road. This alternative would have a higher potential for continued degradation of the roadway surface throughout the road corridor, and particularly in the west end where the North Face Corner pit cannot supply enough material to meet the identified 10-year needs. Lack of adequate maintenance on the park road could, at some point, make it unsafe and difficult for visitors to travel through the park and enjoy its resources. It could also limit access for Kantishna-area visitors, and/or make that access more difficult and less comfortable. Short-term completion of gravel extraction at the North Face Corner site, and reclamation of that site, would eliminate potential traffic-safety risks associated with the proximity of gravel operations to public traffic on the park road and the existence of a relatively sharp curve on the park road at this location. Alternative 1 could lead to major impacts to visitor access and safety along the park road.

Cumulative Impacts: Visitor access and safety has been steadily improved along the Denali Park Road since the Front Country EIS and identification and funding from the Federal Highways Administration to correct problem areas. The lack of a reliable gravel source site at the western end of the park road and the increase in heavy dump truck traffic would likely reverse this trend and result in long-term degradation of the park road and safe conditions for visitor access. Alternative 1 could result in major cumulative impacts to the visitor access and safety.

Conclusion: The no-action alternative would lead to major impacts to visitor access and safety if identified problem areas are not corrected and sections of the park road fail and routine road maintenance falls behind schedule. .

Alternative 2: Maximum Flexibility/Short Hauls

This alternative would produce a sufficient volume and quality of material to meet the identified needs for maintaining and repairing the park road. Maintenance of the park road to the level defined in the applicable standards is the basic requirement to provide safe travel for visitors and safe and effective access for NPS personnel and lodge guests and owners. Park shuttle buses and tour buses are the methods most commonly used by visitors for travel to the park's interior to view wildlife and scenery. Alternative 2 might improve the experience of bus users by increasing the comfort and safety of bus trips on the park road.

Assuming standard safety plans are followed in gravel extraction, processing and hauling operations, this alternative would create negligible increases in safety hazards for park visitors or employees. Alternative 2 would entail potential interaction between park visitor traffic (on foot and in vehicles) and operations activities at the North Face Corner and Camp Ridge sites, which are immediately adjacent to the park road in the Kantishna area. Based on the relatively low volume of traffic in the western end of the road corridor and the fact that virtually all of the vehicles would be operated by NPS, lodge or concessioner personnel, it is expected that the increased safety risk would be minor.

Cumulative Impacts: Visitor access and safety has been steadily improved along the Denali Park Road since the Front Country EIS and identification and funding from the Federal Highways Administration to correct problem areas. This alternative would continue that trend. Short-term safety concerns at the western end of the park road between North Face Corner and Camp Ridge would result in overall minor cumulative impacts to visitor access and safety.

Conclusion: Alternative 2 would result in minor public access and safety risks, mostly at the western end of the park road.

Alternative 3: Minimum Visual Intrusion/Long Hauls

Alternative 3 would support maintenance objectives for the park road to the same degree as Alternative 2, and would help to provide safe travel and effective access for all users of the park road. This alternative would produce a relatively high volume of truck traffic associated with gravel hauling, which could translate into an increased level of traffic safety concern. Based on the incremental change compared to the baseline traffic level, however, potential traffic safety effects should be minor to negligible. As discussed for Alternative 1, reclamation of the North Face Corner site would eliminate potential traffic-safety risks associated with gravel operations adjacent to the park road and the relatively sharp curve on the park road at this location. Assuming standard safety plans are followed in gravel extraction, processing and hauling operations, this alternative would result in minor increases in safety hazards for park visitors or employees.

Cumulative Impacts: Visitor access and safety has been steadily improved along the Denali Park Road since the Front Country EIS and identification and funding from the Federal Highways Administration to correct problem areas. This alternative would continue that trend. Short-term safety concerns at the eastern end of the park road would result from increased gravel truck traffic from external sources. This would in result minor cumulative impacts to visitor access and safety.

Conclusion: Alternative 3 would result in minor public access and safety impacts, mostly at the eastern end of the park road from increased gravel truck traffic.

Alternative 4: Phased Development of Moderate Number of Sites (*NPS Preferred)*

Alternative 4 would support maintenance objectives for the park road to the same degree as discussed previously for Alternative 2, and would help to provide safe travel and effective access for all users of the park road. Gravel production in the Kantishna area would not be located immediately adjacent to the park road (unlike Alternative 2), and there would be a negligible increase in safety risks from traffic interactions. Assuming standard safety plans are followed in gravel extraction, processing and hauling operations, this alternative would result in negligible increases in safety hazards for park visitors or employees.

Cumulative Impacts: Visitor access and safety would continue to be improved along the Denali Park Road since the Front Country EIS and identification and funding from the Federal Highways Administration to correct problem areas. Road conditions would continue to be improved and less truck traffic in visitor concentration areas would result in negligible cumulative impacts to visitor access and safety.

Conclusion: Alternative 4 would result in negligible public access and safety impacts with overall improving conditions in the next 10 years.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

Alternative 5 would support maintenance objectives for the park road to the same degree as discussed previously for Alternatives 2 and 4, and would help to provide safe travel and effective access for all users of the park road. As discussed for Alternative 2, expanded operations at the North Face Corner site would involve minor increased safety risks associated with gravel operations adjacent to the park road in this location. Assuming standard safety plans are followed in gravel extraction, processing and hauling operations, this alternative would result in minor increases in safety hazards for park visitors near the North Face Corner for a short period of time.

Cumulative Impacts: Visitor access and safety would continue to be improved along the Denali Park Road since the Front Country EIS and identification and funding from the Federal Highways Administration to correct problem areas. Road conditions would continue to be improved and less truck traffic in visitor concentration areas would result in negligible cumulative impacts to visitor access and safety.

Conclusion: Alternative 5 would result in minor public access and safety impacts with overall improving conditions in the next 10 years.

PARK MANAGEMENT

The NPS is concerned that gravel source sites for park road maintenance and special projects must be adequate to provide the material requirements estimated for the next 10 years. The sources should be spaced in such a manner as to be efficient and cost-effective without causing unreasonable adverse impacts to park resources and values. The NPS is also concerned that frequent trips with heavy gravel trucks over long haul distances would accelerate wear and tear on the park road. These concerns overlap to a considerable degree with other topics addressed in this EA, including Public Access and Safety.

The NPS has estimated a need for approximately 375,000 cy of borrow material over the next 10 years. All of the alternatives evaluated would be able to provide enough material to accomplish the maintenance and repair goals of the gravel acquisition plan, although the alternatives differ considerably in their reliance on in-park versus external material sources. The park management concerns for which the alternatives could produce variable results include cost, impacts to the road character and condition through wear and tear, and the level of increased traffic on the park road.

Alternative 1: No Action

Under this alternative, Teklanika Pit, Toklat River and North Face Corner would remain the only approved material extraction sites along the park road. The gravel needs at the western end of the road for maintenance, repairs, and construction exceed 10,000 cy per year. Under this alternative, material would have to be hauled to the western end from the Toklat River site at Mile 53 after the North Face Corner supply is exhausted. The NPS could choose to haul the material this distance, haul material from outside sources to the western end or lower the design or maintenance standards for the west end of the road.

Hauling gravel from Toklat to the western end would cause excessive hauling costs and would limit the ability to use gravel from Toklat in other areas of the park. Hauling gravel from external sources to the western end of the road would be prohibitively expensive and would further degrade the road surface. Lowering the standards for road performance would decrease the ability of the road to function as a safe and accessible way for the public to visit the park and view its resources. Any of these options would inhibit proper management of the park road, as directed in the GMP. Lastly, the NPS may need to count gravel trucks against the GMP seasonal road limits, thereby reducing the number of visitor vehicles and creating management controversy.

Cumulative Impacts: The existing road maintenance efforts would be incrementally increased over existing levels with this alternative because the additional heavy vehicle traffic over the road would accelerate wear and tear. Mostly larger 18-yard belly dump gravel trucks would be used to transport gravel from external source sites, exacerbating the impacts to the park road. Road maintenance costs would be increased dramatically because gravel would need to be hauled longer distances, and hauling costs are the major component of the overall costs. In addition, the NPS record of decision for the Front Country EIS calls for the reduction of photographer permits by 50 % to allow for a reallocation to buses under the 10,512 annual vehicle limit, which replaces lighter vehicles with heavier buses and increases road impacts. These combined effects would result in major cumulative impacts to park management.

Conclusion: Alternative 1 would result in major impacts to park operations and management.

Alternative 2: Maximum Flexibility/Short Hauls

This alternative is capable of producing more borrow material than is required over the next 10 years. It would also decrease (compared to Alternative 1) gravel hauling mileage by distributing extraction sites throughout the road corridor. Accordingly, it would reduce road degradation by decreasing haul distances and truck trips. Total gravel vehicle mileage under Alternative 2 would be equivalent to 7 percent of the existing level for visitor and administrative activity. The authorized gravel sites would not all be active simultaneously, which would lesson the impact on the road character due to truck traffic and the visual presence of industrial equipment and human activity. Park maintenance staff could adjust to the change in gravel source sites in a year or two. This alternative would require park management to acquire and install a temporary bridge over Moose Creek to extract gravel from Downtown Kantishna.

Cumulative Impacts: The amount of gravel truck traffic and impacts to the park road would be slightly increased over recent years and gravel production and hauling costs would be commensurate with recent years. The NPS record of decision for the Front Country EIS calls for the reduction of photographer permits by 50 % to allow for a reallocation to buses under the 10,512 annual vehicle limit, which replaces lighter vehicles with heavier buses and increases road impacts. Few dump trucks would transport external source gravel into the park and no reallocations of vehicles under the 10,512 limit would be contemplated. These effects would result in minor cumulative impacts to park management.

Conclusion: The overall impacts of Alternative 2 on park operations and management would be minor.

Alternative 3: Minimum Visual Intrusion/Long Hauls

This alternative would have the capability to produce more than enough material to meet park road maintenance needs over the next 10 years. Other than the no-action alternative (Alternative 1), this alternative is scheduled to produce the smallest amount of borrow material from sources within the park. The consequence of this would be a heavy reliance on external sources that would likely cause both increased truck traffic on the road and increased cost due to purchase and transport of material from outside the park. These long haul distances would measurably increase the expense of road maintenance relative to Alternatives 2, 4 or 5. The 12 percent increase in trucks hauling gravel would also be more frequently visible to visitors along the park road, thereby altering the road's character, and would cause increased wear and tear on the road. In turn, this effect would require increased maintenance and gravel requirements, along with increased hauling costs and decreased usability of the park road for visitors. Both of these impacts would adversely affect the character of the road. The NPS may need to count gravel trucks against the GMP seasonal road limits, thereby reducing the number of visitor vehicles and creating management controversy. This alternative would, however, be more consistent with NPS policies to produce mineral materials from external sources when feasible.

Cumulative Impacts: The cumulative impacts of Alternative 3 on park operations and management would be similar to but less than those described for alternative 1 because less gravel from external sources would need to be imported and a western source of gravel would reduce overall hauling distances. Larger 18-yard belly dump gravel trucks would be used to transport gravel from external source sites, exacerbating the impacts to the eastern part of the park road. Road maintenance costs would be moderately increased because gravel would need to be hauled long distances, and hauling costs are the major component of the overall costs. These effects would result in moderate cumulative impacts to park management.

Conclusion: The impact of Alternative 3 on park operations and management would be moderate.

Alternative 4: Phased Development of Moderate Number of Sites (*NPS Preferred*)

This alternative would be able to produce more than enough material to meet projected needs over the next 10 years. Alternative 4 would require only an estimated 12,500 cy from external sources, which would be used in repairs on road sections 1 through 3. The distribution of extraction, processing and stockpiling sites along the park road under Alternative 4 would reduce hauling distances and cost relative to Alternative 3. The decreased need for long haul distances would also reduce the number of trucks seen by visitors, dust created by the trucks and noise, thereby reducing the impacts on park road character relative to Alternative 3. Overall, impacts from this alternative on park operations and management would be virtually the same as for Alternative 2, and would be minor.

Cumulative Impacts: The cumulative impacts of Alternative 4 would be similar to those described for alternative 2 and would be minor.

Conclusion: Overall, impacts from Alternative 4 on park operations and management-would be virtually the same as for Alternative 2, and would be minor.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

Similar to Alternative 4, Alternative 5 could produce more than enough material to meet gravel requirements for the next 10 years. Compared to Alternative 4, gravel hauling activity from Alternative 5 would be very slightly less and would likely have no differential effect on the character of the park road.

Cumulative Impacts: The cumulative impacts of Alternative 5 would be similar to those described for Alternatives 2 and 4, and would be minor.

Conclusion: Impacts on park operations and management-from Alternative 5 would be essentially the same as Alternatives 2 or 4, and would be minor.

LOCAL ECONOMY

Purchases of gravel from sources outside the park could provide economic benefits to private-sector mineral material owners and contractors. The extent to which this would occur would depend upon the amount of material purchased from outside sources and the haul distances from those sources to points of use in the park. Gravel purchases represent the primary way in which the gravel acquisition plan could have a direct impact on the local economy. A potential means of indirect impact involves the relationship between maintenance of the park road and the economic interests of lodge operators and concessioners. Businesses in the Kantishna area depend upon adequate maintenance of the park road for access by their customers. Gravel acquisition alternatives that would support adequate maintenance of the road would help to sustain those businesses, while failure to adequately maintain the road would be an economic threat to west-end commercial operations.

The cost of purchasing and transporting gravel produced outside the park represents a substantial element of the total cost of each alternative. In 2000, the NPS purchased 15,150 cy of material from

external sources at a cost of $790,000 (see Appendix A). In 2001, 3,588 cy were purchased for $650,000, and projects implemented in 2002 included 3,200 cy of external gravel were purchased for $500,000. The differences in cost reflect differences in type of gravel as well as differences in project scopes. These costs represent revenues to the local economy; they directly and indirectly help to support employment and payrolls in communities outside the park.

Alternative 1: No Action

Under this alternative 220,000 to 240,000 cy of gravel are expected to be purchased from external material sources over the next 10 years. The prices that would be paid for this gravel would vary for a number of reasons, and do not readily translate into a specific revenue stream to the local economy. Based on the assumptions used in the cost analysis of material sources performed for this study (see Appendix B), Alternative 1 was calculated to cost over $8.5 million for external gravel purchases over 10 years, or an average of $850,000 per year if contractor crews transported the purchased material. Gravel purchases at this level would represent a substantial increase over what the NPS has spent locally for gravel in the past 3 years. Consequently, Alternative 1 would produce a larger impact in the local economy and a benefit for external gravel producers. It is possible that the increased expenditures could support increased employment locally in the mining sector, although any change in employment would likely be small.

As discussed under Park Management, Alternative 1 would not provide sufficient in-park gravel for adequate maintenance of the park road. The reliance on external gravel resources to maintain and repair the road and increased haul mileage under this alternative would create a higher potential that the condition of the road would degrade. Over time, this could cost the Kantishna area lodges more to maintain and operate their fleet of vehicles and they might have to charge visitors more.

Other possible types of economic changes would not be expected under this alternative. Visitor patterns in the entrance area of the park would not likely change, so commercial businesses outside the entrance area would not likely be affected. Because this alternative would not result in expanded in-park material extraction, processing, or storage activities, the Park Service would not need to increase its number of employees to accommodate the alternative.

Cumulative Impacts: Compared to the existing level of influence of park visitation and operations on the local economy, the cumulative impacts of Alternative 1 would be minor.

Conclusion: Overall, the impacts of Alternative 1 on the local economy would likely be minor. There is some potential for offsetting impacts, with positive economic effects from gravel and possible negative effects if costs were increased for lodge operators.

Alternative 2: Maximum Flexibility/Short Hauls

The increase in gravel extraction sites and volumes within the park proposed for Alternative 2 could result in an increase in park employment to support these activities. However, because most of the sites would operate in the summer season and the rest in the shoulder season, any new employees would most likely be seasonal. The impact of such an increase is likely to be negligible within the local economy.

Alternative 2 involves purchase of an estimated 12,500 cy of material from external material sources. On an annual basis, this could represent a smaller volume of external purchases than in recent years.

Truck operators and gravel producers outside the park might experience a decrease in revenues from the NPS, but the effects would not likely be significant based on the potential magnitude of change.

This alternative would provide sufficient gravel to meet the material needs for maintenance and improvement of the park road. This would not change the number of visitors traveling to the Kantishna lodges, but would continue a service level that is important to those businesses. Alternative 2 would be unlikely to promote changes in park use patterns that would influence the local service economy outside the park.

Cumulative Impacts: Compared to the existing level of influence of park visitation and operations on the local economy, the cumulative impacts of Alternative 2 would be negligible.

Conclusion: Overall, based on the types and magnitude of potential economic effects identified, impacts to the local economy from Alternative 2 would be negligible.

Alternative 3: Minimum Visual Intrusion/Long Hauls

The impacts of this alternative would be very similar to those from Alternative 1. A substantial amount of material (120,000 to 130,000 cy) would be imported from external sources, which would generate nearly $3.7 million in revenue for road work contractors, local gravel suppliers, and trucking sub-contractors over 10 years. Total vehicle miles generated by gravel hauling would also increase, relative to Alternative 2, because of the limited distribution of proposed sites along the road corridor.

Alternative 3 would provide sufficient gravel to meet the material needs for maintenance and improvement of the park road. The effects of this alternative on local-area businesses would be beneficial because of the large amount of material needed from external sources and the level of truck activity needed to transport the material.

Cumulative Impacts: Compared to the existing level of influence of park visitation and operations on the local economy, the cumulative impacts of Alternative 3 would be minor.

Conclusion: As discussed for Alternative 1, the overall impacts of Alternative 3 on the local economy would likely be minor.

Alternative 4: Phased Development with Moderate Number of Sites (*NPS Preferred)*

As with Alternative 2, the increase in proposed gravel extraction sites and volumes within the park might require an increase in NPS employment. If so, the employees would likely be seasonal. It is unlikely that this alternative would require more than a small increase in NPS employment.

Under Alternative 4, the volume of material purchased from external sources and the amount of revenue to those sources would be the same as for Alternative 2. Alternative 4 would, like Alternative 2, provide sufficient gravel to meet the material needs for maintenance and improvement of the park road. The effects of this alternative on conditions for businesses in the Kantishna area and outside the park entrance would be the same as described for Alternative 2.

Cumulative Impacts: Compared to the existing level of influence of park visitation and operations on the local economy, the cumulative impacts of Alternative 4 would be negligible.

Conclusion: Overall, based on the types and magnitude of potential economic effects identified, impacts to the local economy from Alternative 4 would be negligible.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

The effects of Alternative 5 on the local economy would be virtually the same as those described for Alternative 4. The volume of material purchased from external sources and the amount of revenue to those sources would be small, and the same as for Alternatives 2 and 4. Alternative 5 would, like Alternatives 2-4, provide sufficient gravel to meet the material needs for maintenance and improvement of the park road. The effects of this alternative on businesses in the Kantishna area and outside the park entrance would be the same as described for Alternative 2.

Cumulative Impacts: Compared to the existing level of influence of park visitation and operations on the local economy, the cumulative impacts of Alternative 5 would be negligible.

Conclusion: Overall, based on the types and magnitude of potential economic effects identified, impacts to the local economy from Alternative 5 would be negligible.

SUBSISTENCE

There are approximately 320 local rural residents who qualify for subsistence use within Denali National Park and Preserve (see Appendix G). Since 1980, the overall populations for most communities surrounding Denali have increased, but the relative number of subsistence users actively involved in subsistence at Denali has remained about the same.

Subsistence community profile studies were conducted for most of Denali's subsistence communities in the early 1980s. The studies indicated that the region's main subsistence species were moose, caribou, ptarmigan, spruce grouse, hare, and a few species of fresh water fish. Large mammals accounted for 70% of the resources used, and fish accounted for 21%.

The subsistence region in the park/preserve provides only a small portion of the estimated subsistence harvest by the people of the resident zone communities of Cantwell, Minchumina, Nikolai, Telida, and by other eligible people. A significant portion of the subsistence use area for these communities is adjacent to the eastern and western boundaries of the Denali National Park and Preserve. In general, the NPS estimates that subsistence harvest from the park/preserve, for certain species, constitutes slightly more than 25% of total harvests in the entire subsistence region.

Common patterns of local use include traveling to the park/preserve by traditional means, such as on foot, by dog sled, motorboat, snowmobile, and occasionally by airplane. Access to the Kantishna Hills for subsistence is by vehicles via the park road during summer and by snowmobile during the winter. Snowmobile use in the Kantishna Hills by subsistence users is rare.

There are no subsistence users who currently reside in the Kantishna area. A limited amount of hunting, fishing, and trapping occurs in the Kantishna Hills because of its distance to resident zone communities. At present up to 10 persons may be expected to hunt or trap annually in the Kantishna Hills area. Current subsistence use of the Kantishna Hills has been primarily for hunting moose and berry picking. Users were primarily from McKinley Village and Cantwell. The caribou-hunting season has been closed in this area since 1977 due to the significant decline of the Denali caribou

herd. Past subsistence use of the Kantishna Hills area was primarily for hunting moose and caribou in the fall and for trapping during the winter. Occasionally, subsistence users would use ptarmigan, fish, or berries.

Based on existing and authorized subsistence use patterns relative to the proposed distribution of gravel sites, none of the gravel acquisition plan alternatives is likely to have an effect on the availability or distribution of subsistence resources, access to the resources by subsistence users, or competition among users for subsistence resources. A detailed assessment of the affects of the proposal on subsistence use pursuant to Section 810 of ANILCA is provided as Appendix F to this EA, and provides support for the conclusions summarized below.

Alternative 1: No Action

This alternative would have no direct or indirect effects on subsistence activities in the Kantishna area because no gravel sources would be developed there. Gravel would be imported from the Toklat River after the North Face Corner is restored.

Cumulative Impacts: At present a one-mile firearms discharge closure exists around the Denali Park Road in the Kantishna area (10 square miles) for the summer season and until the lodges are vacated around September 15. These effects were judged to have a minor and insignificant effect on subsistence uses in the area. Alternative 1 would have no additional effects on subsistence.

Conclusion: Alternative 1 would have negligible effects on subsistence uses in Denali National Park and Preserve. Alternative 1 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 2: Maximum Flexibility/Short Hauls

Alternative 2 would involve the development and use of 4 gravel source sites in the Kantishna subsistence area: North Face Corner, Camp Ridge, Downtown Kantishna, and Kantishna Airstrip. All of these sites lie within the firearms closure area, but development and use of these sites after September 15 (when processing and stockpiling activities would be most intensive) could have a minor effect on subsistence moose hunting in fall. The firearms closure would likely not be extended area wise, but the period of closure could be lengthened to protect workers in the area after September 15. Most subsistence hunters travel up Moose Creek, however, so the geographic effects would be small and the temporary.

Cumulative Impacts: At present a one-mile firearms discharge closure exists around the Denali Park Road in the Kantishna area for the summer season (10 square miles) and until the lodges are vacated around September 15. These effects were judged to have a minor and insignificant effect on subsistence uses in the area. Alternative 2 would have minor additional effects on subsistence uses in the area.

Conclusion: Alternative 2 would result in minor direct and indirect impacts on subsistence uses in Denali National Park and Preserve. The overall level of subsistence impacts under Alternative 2 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 3: Minimum Visual Intrusion/Long Hauls

Minor effects to access for subsistence use could occur near the Moose Creek Terrace site. The firearms use restriction may need to be extended both in space and time to protect park maintenance workers in the area after September 15, but the geographic area would be small and the period of time would be a few weeks at most.

Cumulative Impacts: At present a one-mile firearms discharge closure exists on both sides of the Denali Park Road in the Kantishna area (10 square miles) for the summer season and until the lodges are vacated around September 15. These effects were judged to have a minor and insignificant effect on subsistence uses in the area. Alternative 3 would result in less than one square mile and a few weeks additional firearms closure, which would have minor additional effects on subsistence uses in the area.

Conclusion: Alternative 3 would result in minor direct and indirect impacts to subsistence resources or uses within the park. The overall level of subsistence impacts under Alternative 3 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 4: Phased Development with Moderate Number of Sites (*NPS Preferred)*

As discussed in Alternatives 2 and 3, small geographic and temporal restrictions on firearms discharge for subsistence uses could be extended to protect gravel workers near the Downtown Kantishna and the Moose Creek Terrace sites.

Cumulative Impacts: At present a one-mile firearms discharge closure exists around the Denali Park Road in the Kantishna area (10 square miles) for the summer season and until the lodges are vacated around September 15. These effects were judged to have a minor and insignificant effect on subsistence uses in the area. Alternative 4 would result in less than one square mile and a few weeks additional closure, which would have minor additional effects on subsistence uses in the area.

Conclusion: Alternative 4 would result in minor direct and indirect impacts to subsistence resources or uses in the park. The overall level of subsistence impacts under Alternative 4 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 5: Most Economic Alternative with Moderate Hauls

This alternative would have similar effects on subsistence uses in Denali National Park and Preserve as described for alternative 2, except just two gravel source sites would be involved in the Kantishna area: Downtown Kantishna and North Face Lodge.

Cumulative Impacts: At present a one-mile firearms discharge closure exists around the Denali Park Road in the Kantishna area for the summer season (10 square miles) and until the lodges are vacated around September 15. These effects were judged to have a minor and insignificant effect on subsistence uses in the area. Alternative 5 would have minor additional effects on subsistence uses in the area.

Conclusion: Alternative 5 would result in minor direct, indirect, and cumulative impacts to subsistence resources or uses within the park. The overall level of subsistence impacts under Alternative 5 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

WILDERNESS

Nearly the entire Denali Park road runs through the former Mount McKinley National Park, 95% of which is currently designated wilderness. The wilderness exclusion zone consists primarily of the entrance area and a 300-foot-wide road corridor (150 feet on either side) with wider development nodes at certain locations along the 90-mile length of the road. Lands within the road corridor are designated Park Development Zones and are managed to accommodate major development and intensive use. Lands within Park Development Zones are to be managed to minimize human disturbance on adjacent park wilderness.

None of the proposed gravel acquisition sites, with the exception of a portion of the East Fork River site (see discussion below) are located on designated wilderness land. Impacts of the alternatives on wilderness would be limited to indirect auditory and visual intrusions. Visual intrusions are addressed in the Scenic Values section of this EA, and are not duplicated below. Auditory intrusions might affect either visitor experience or wildlife use within the affected area. Both would be limited to times of active gravel operations and would be temporary in nature. More specific impacts on wildlife are covered in the Wildlife Values and Habitat section of the EA.

Alternative 1: No Action

Under this alternative, Teklanika Pit, Toklat River and North Face Corner (for a limited time) would be the only approved material extraction sites along the park road. None of these three sites is located in designated wilderness areas. Both the Teklanika Pit and the Toklat River sites are located within non-wilderness development nodes along the park road corridor and the North Face Corner lies about 1 mile north of the wilderness boundary. The only possible impacts these sites might have on wilderness values would be auditory intrusions on the solitude of nearby wilderness lands. The potential impacts on wilderness from the existing authorized borrow sites were previously evaluated by the NPS (1992); none of these analyses found that operations at these sites would create significant adverse impacts on the adjacent wilderness. Given the projected increase in truck traffic along the park road, including at night, Alternative 1 would introduce additional noise disturbance to adjacent wilderness areas along the park road corridor, thereby decreasing the area where peace and solitude could be obtained.

Cumulative Impacts: Because Alternative 1 would result in additional disturbance to the peace and solitude in wilderness areas adjacent to the park road from dump truck traffic, including at night, the cumulative impacts of this alternative to wilderness would be minor.

Conclusion: Alternative 1 would result in minor indirect impacts to wilderness values in the park. The overall level of potential wilderness impacts under Alternative 1 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 2: Maximum Flexibility/Short Hauls

This alternative would authorize extraction of mineral material from up to eight sites and the use of North Face Corner for stockpiling and processing material. With one partial exception, all of the proposed sites lie outside the wilderness boundary, either in non-wilderness development nodes along the park road corridor or in the Kantishna area. The most likely adverse impact of this alternative would be auditory intrusions on adjacent wilderness land from gravel extraction and processing operations, and possible visual intrusion at some of the sites (see Scenic Values). The proposed East Fork River extraction site, as delineated in Appendix C, extends into designated wilderness. Because mechanized equipment cannot be operated within wilderness, the NPS would not fully implement the mining plan reflected in Appendix C. Consequently, the NPS would likely utilize the East Fork River site primarily in response to emergencies, such as road failures, or the area and volume of extraction would be limited.

This alternative includes the most new extraction, processing and storage sites. Relative to the other alternatives, this would create the most extensive noise impact around development sites. Alternative 2 would result in low overall hauling mileage, however, which would reduce noise impacts from hauling material.

Cumulative Impacts: Alternative 2 would result in additional noise disturbance to wilderness values of peace and solitude above existing road traffic and existing administrative sites along the road corridor from new extraction sites (East Fork River, Beaver Pond, and Boundary). Because the geographic extent of the additional noise impacts to wilderness values would be small, the cumulative impacts of this alternative to wilderness would be minor.

Conclusion: Alternative 2 would result in minor overall impacts to wilderness values in the park. The overall level of potential wilderness impacts under Alternative 2 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 3: Minimum Visual Intrusion/Long Hauls

This alternative would involve maintaining two of the current three material extraction sites and adding one new site located near the end of the park road and approximately 1 mile north of the wilderness boundary. As described for Alternative 1, the existing sites are located in road corridor development nodes and outside the wilderness boundary. The effects of operational noise from this alternative on wilderness values would be very similar to those discussed for Alternative 1. Alternative 3 would result in less noise in wilderness areas near the Teklanika Pit, but an offsetting increase in noise from truck traffic hauling gravel from outside sources along the eastern end of the road corridor.

Cumulative Impacts: Alternative 3 would result in additional noise disturbance to wilderness values of peace and solitude above existing road traffic and existing administrative sites along the road corridor from 175,000 miles of dump truck traffic. Because the additional noise impacts to wilderness values would be audible a short distance, the cumulative impacts of this alternative to wilderness would be minor.

Conclusion: As discussed for Alternative 1, Alternative 3 would result in minor indirect impacts to wilderness values in the park. The overall level of potential wilderness impacts under Alternative 3

would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 4: Phased Development with Moderate Number of Sites (*NPS Preferred)*

With the partial exception of the East Fork River site, as discussed above for Alternative 2, none of the proposed gravel sites included in Alternative 4 are within designated wilderness. Because part of the East Fork River site identified in Appendix C extends into designated wilderness, the NPS would utilize this site primarily in response to emergencies, such as road failures. As with the other alternatives, auditory and visual intrusions would be the only potential sources of change to wilderness values. Under this alternative it is likely that five in-park gravel sources could be used at the same time, which represents an increase of only two operating sites compared to the current condition. Vehicle noise effects to wilderness would not increase noticeably under this alternative.

Cumulative Impacts: In addition to existing noise impacts to wilderness values described in Alternatives 1-3, Alternative 4 would result in two new extraction areas adjacent to park wilderness (East Fork and Beaver Pond). Gravel extraction activities at these two sites would introduce additional localized noise impacts to surrounding designated wilderness, which would constitute minor cumulative impacts to the character of wilderness resources in the park.

Conclusion: Alternative 4 would create the potential for minor indirect impacts to wilderness values in the park. The overall level of potential wilderness impacts under Alternative 4 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.

Alternative 5: Economic Alternative with Moderate Hauls *(NPS Preferred)*

The effects of this alternative on wilderness values would be essentially the same as those of Alternative 4.

Cumulative Impacts: As discussed for Alternative 4, Alternative 5 would result in overall minor cumulative impacts to the character of wilderness resources in the park.

Conclusion: Alternative 5 would result in minor indirect impacts to wilderness values in the park. The overall level of potential wilderness impacts under Alternative 5 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are key to the natural integrity of the park.